Regional Operational Plan SF.2A.2013.21

Ninilchik Chinook Salmon Stock Assessment and Supplementation, 2013

by

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and

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November 2013

Alaska Department of Fish and Game **Divisions of Sport Fish and Commercial Fisheries**

Symbols and Abbreviations

The following symbols and abbreviations, and others approved for the Système International d'Unités (SI), are used without definition in the following reports by the Divisions of Sport Fish and of Commercial Fisheries: Fishery Manuscripts, Fishery Data Series Reports, Fishery Management Reports, and Special Publications. All others, including deviations from definitions listed below, are noted in the text at first mention, as well as in the titles or footnotes of tables, and in figure or figure captions.

Weights and measures (metric)

centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
milliliter	mL
millimeter	mm

Weights and measures (English)

cubic feet per second	ft^3/s
foot	ft
gallon	gal
inch	in
mile	mi
nautical mile	nmi
ounce	oz
pound	lb
quart	qt
yard	yd

Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
degrees kelvin	K
hour	h
minute	min
second	s

Physics and chemistry

all atomic symbols	
alternating current	AC
ampere	A
calorie	cal
direct current	DC
hertz	Hz
horsepower	hp
hydrogen ion activity (negative log of)	pH
parts per million	ppm
parts per thousand	ppt, ‰
volts	V
watts	W

General

Alaska Administrative Code	AAC
all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.
all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.
at	@
compass directions:	
east	E
north	N
south	S
west	W
copyright	©
corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
District of Columbia	D.C.
et alii (and others)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.
Federal Information Code	FIC
id est (that is)	i.e.
latitude or longitude	lat. or long.
monetary symbols (U.S.)	\$, ¢
months (tables and figures): first three letters	Jan,...,Dec
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S.C.	United States Code
U.S. state	use two-letter abbreviations (e.g., AK, WA)

Mathematics, statistics

all standard mathematical signs, symbols and abbreviations	
alternate hypothesis	H_A
base of natural logarithm	*e*
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	(F, t, χ^2, etc.)
confidence interval	CI
correlation coefficient (multiple)	R
correlation coefficient (simple)	r
covariance	cov
degree (angular)	°
degrees of freedom	df
expected value	*E*
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	$\log_2$, etc.
minute (angular)	'
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	"
standard deviation	SD
standard error	SE
variance	
population	Var
sample	var

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NINILCHIK CHINOOK SALMON STOCK ASSESSMENT AND SUPPLEMENTATION, 2013

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Signature Page

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Approval

Title	Name	Signature	Date
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PURPOSE

This project is designed to monitor wild Chinook salmon escapement to ensure sustainability of the stock and to conduct egg takes to provide additional fishing opportunities within the Ninilchik River and terminal salt water fisheries in Kachemak Bay. Chinook salmon escapement will be indexed from July 3-31 at a broodstock weir located approximately 7.7 RKM. The index will be compared to a sustainable escapement goal (SEG) range of 550-1300 wild Chinook salmon.

BACKGROUND

Ninilchik River is located on the Kenai Peninsula in the Lower Cook Inlet management area (LCIMA) (Figure 1). It is a small (anadromous stream length 81 river kilometers [RKM]), non-glacial, anadromous stream with extensive wetlands (122 km^2), and no large tributary lakes. There are only three road accessible streams in the LCIMA that support Chinook salmon *Onchorhynchus tshawytscha* sport fisheries: Ninilchik River, Anchor River, and Deep Creek. Angler effort is focused on Ninilchik River earlier in the season because water conditions are generally less turbid than Anchor River or Deep Creek. Sport anglers are capable of harvesting a significant portion of the Ninilchik River Chinook salmon run because of its small stream size and accessibility. From 1999 through 2008, the average annual harvest estimate of Ninilchik River Chinook salmon was about 1,400 fish. From 2009 through 2011, the average annual harvest estimate of Ninilchik River Chinook salmon has dropped to under 300 fish.

In the mid 1980s, the Alaska Department of Fish and Game (ADF&G) Division of Sport Fish (SF) recognized that the Ninilchik River Chinook salmon stock was vulnerable to overharvest from the growing Kenai Peninsula sport fishery. In 1987, SF initiated a supplementation program for the Ninilchik River as a way to create sustainable fishing opportunities through stocking hatchery-reared Chinook salmon smolt. As a result of the supplementation program, two groups of Chinook salmon (wild and hatchery-reared) now return to the Ninilchik River, which has added an additional level of complexity to the management of escapement and harvest of Ninilchik River Chinook salmon.

The following sections summarize the supplementation program and escapement monitoring, the tools used to evaluate the sport harvest of hatchery-reared fish, and management strategies.

SUPPLEMENTATION

The annual supplementation of Chinook salmon for Ninilchik River has remained essentially unchanged since 1995 when stocking levels were reduced to 50,000 smolt (from approximately 200,000 smolt) with 100% of the smolt adipose-clipped and coded-wire-tagged (CWT).

Since 1988, broodstock collection and egg takes were conducted at a broodstock weir located at Brody Road bridge (7.7 RKM) during the month of July and early August (Figure 2). Only the progeny from wild Chinook salmon broodstock are used for Ninilchik River stockings. From 1988 through 2002, Chinook salmon smolt were stocked as age-0 fish. From 2003 through 2011, due to limited hatchery rearing facilities, all stocked Chinook salmon have been overwintered in the hatchery as parr and released in the spring as age-1 smolt. Starting in 2012, all Ninilchik River hatchery-reared Chinook salmon are reared in the new William Jack Hernandez Hatchery (WJHH) in Anchorage and stocked as age-0 smolt.

Starting in 1994, additional broodstock from the Ninilchik River was collected to support stocking at the terminal saltwater fisheries in Kachemak Bay at Nick Dudiak Fishing Lagoon (NDFL) on Homer Spit, Halibut Cove Lagoon (HCL) and Seldovia Bay (Figure 1). A combination of both wild and hatchery-reared Chinook salmon are used as broodstock for the terminal saltwater fisheries.

ESCAPEMENT MONITORING

ADF&G has monitored Chinook salmon escapement in Ninilchik River since 1962. Starting in 1999, all hatchery-reared Chinook salmon returning to Ninilchik River were adipose-clipped and CWT. Since then, all weir counts of wild and hatchery-reared Chinook salmon have been differentiated by examining all Chinook salmon at the weir for the presence or absence of an adipose fin. Currently, escapement is monitored at the broodstock weir during an index monitoring period and not over the entire run (Table 1). The Chinook salmon escapement is calculated by removing the holding and egg-take mortalities from the Chinook salmon weir count. On average (1999–2005), 65% of the total wild Chinook salmon weir escapement was counted during the index monitoring period. This index fails to account for spawning below the weir which may consist of approximately 35% of the total spawning escapement based on aerial survey data and the composition (wild/hatchery-reared) of this escapement is unknown (Marsh *unpublished*[1]).

Escapement Goal

The sustainable escapement goal (SEG) range for the wild Ninilchik River Chinook salmon is 550-1,300 fish during the index monitoring period (July 3-31). This SEG was calculated using the percentile method (Bue and Hasbrouck *unpublished)*[2], and is based on the wild escapement above the weir during the index monitoring period from 1999 through 2007 (Otis and Szarzi 2007).

SPORT HARVEST

Monitoring the Chinook salmon sport harvest at Ninilchik River has become more complicated since the inception of the supplementation program. The Alaska Statewide Harvest Survey (SWHS) estimates, by area and by fishery, the participation, harvest (fish kept), and catch (fish harvested plus fish released) of sport-caught species. Unfortunately, the SWHS does not provide the stock composition (wild/hatchery-reared) of the harvest.

From 1991 through 2006, periodic assessment of the hatchery-reared contribution to the sport harvest, has been conducted with creel and sport harvest surveys. During runs from high stocking years (1990–1998), these surveys found over 50% of the harvest was hatchery-reared fish (Balland and Begich 2007; Balland et al. 1994; Begich 2006, 2007; Boyle and Alexandersdottir 1992; Boyle et al. 1993; Marsh 1995; Marsh, memorandum). In 2006, the hatchery-reared percentage of the Chinook salmon harvest during the 3 regulatory 3-day weekend fishery was 39% (Booz and Kerkvliet 2011a).

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1 L. E. Marsh, 1997 memorandum to B. Clark, ADF&G, on preliminary evaluation of the stocking program at the Ninilchik River. Subsequently referred to as the *Marsh, memorandum*.

2 Bue, B. G., and J. J. Hasbrouck. Unpublished. Escapement goal review of salmon stocks of Upper Cook Inlet. Alaska Department of Fish and Game, Report to the Alaska Board of Fisheries, November 2001 (and February 2002), Anchorage. Subsequently referred to as *Bue and Hasbrouck, unpublished*.

MANAGEMENT

The sport fishery regulations for Ninilchik River Chinook salmon are designed to conservatively manage for the sustainability of the wild stock. The regulations restrict harvest opportunity by limiting the area open to fishing to the lower 3.2 RKM of the river (to protect the Chinook salmon spawning area), and by limiting fishing openings to 3 consecutive 3-day weekends (Saturday through Monday) beginning on Memorial Day weekend. Starting in 2008, the regulatory sport Chinook salmon fishery in the Ninilchik River includes opportunity to harvest only hatchery-reared Chinook salmon in the lower 3.2 RKM of the river from 1 July through 31 December.

Management of Chinook salmon in the Ninilchik River has been refined since the inception of the supplementation program with a more directed focus towards maximizing the harvest of hatchery-reared fish. From 1991 through 2001, SF has periodically issued Emergency Orders (EOs) to increase the number of fishing days for both wild and hatchery-reared Chinook salmon. Starting in 2002, EOs increased fishing days for hatchery-reared fish only.

In 2004, the Alaska Board of Fisheries (BOF) adopted a regulation that increased the daily bag limit for Ninilchik River Chinook salmon from 1 to 2 of which no more than 1 fish could be a wild Chinook salmon. The intent of this regulation was to increase the harvest of hatchery-reared Chinook salmon.

From 2010 through 2012, the Ninilchik River Chinook salmon sport fishery has been restricted each year in various ways through EO to reduce harvest to ensure adequate escapement.

This project is designed to monitor wild Chinook salmon escapement to ensure sustainability of the stock and conduct egg takes to provide additional fishing opportunities within the Ninilchik River and terminal salt water fisheries. This operational plan will serve to outline the annual objectives and tasks and to describe how they will be met.

OBJECTIVES

1. Census the Ninilchik River wild and hatchery-reared Chinook salmon run and escapement[3] at 7.7 RKM from July 3 through July 31.
2. Census the sex composition of the Ninilchik River wild and hatchery-reared Chinook salmon run at 7.7 RKM from July 3 through July 31.
3. Estimate the age composition of the Ninilchik River wild Chinook salmon run at 7.7 RKM from July 3 through July 31, 2013 such that the estimates of each group are within 10 percentage points of the true values 95% of the time.
4. Census the age composition of the Ninilchik River hatchery-reared Chinook salmon run at 7.7 RKM from July 3 through July 31.
5. Estimate the wild/hatchery-reared composition of the Chinook salmon run in late June, prior to the July sport fishery such that the estimates of each group are within 10 percentage points of the true values 90% of the time.

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[3] Run and escapement differ by the number of fish sacrificed for broodstock.

SECONDARY OBJECTIVES

1. Collect, hold, and artificially spawn 111 male and 111 female Chinook salmon during July from the Ninilchik River (minimum of 60 wild males and 60 wild females to ensure genetic variation) for future hatchery releases to the Ninilchik River, HCL, Seldovia, and the NDFL on the Homer Spit.
2. Release approximately 50,000 Chinook salmon smolt in the Ninilchik River, 64,150 smolt in HCL, 64,150 smolt in Seldovia, and 210,000 smolt in NDFL from May through June.
3. Estimate length at age for the Ninilchik River hatchery-reared and wild Chinook salmon run at 7.7 RKM.
4. Estimate within reader variability of age estimates from scale readings.
5. Collect all heads from hatchery-reared Chinook salmon used for eggtakes for CWT extraction and decoding; CWT data will be used to identify stray fish and to associate a known age with scales for accuracy assessment.
6. Compare the known proportion of jacks calculated from weir counts to the proportion estimated from the age sample; this comparison will test the hypothesis that our age sample is representative.
7. Collect kidney samples from all sacrificed female Chinook salmon from egg takes to test for Bacterial Kidney Disease (BKD).
8. Measure daily water temperature and depth at the weir.
9. Collect water temperature, salinity, and dissolved oxygen saturation and concentration data every fifteen minutes using a sonde at NDFL from May 1 through July 31.
10. Quantify *Chaetoceros spp.* concentrations around stockings at NDFL and HCL.

METHODS

STUDY AND SAMPLING DESIGN

There are three main components to this project: 1) escapement monitoring and biological sampling; 2) egg takes; and 3) smolt releases. From July 3 through July 31, escapement will be monitored and sampled with a fixed picket weir. The weir will be installed approximately 7.7 RKM from the mouth and 15 m downstream of the Brody Road Bridge (Figure 2). Egg takes will be conducted at the weir site. Hatchery personnel in cooperation with Homer ADF&G staff will stock smolt into net pens at the terminal saltwater fisheries in Kachemak Bay. Homer ADF&G staff will feed, assess mortality and release held smolt.

ESCAPEMENT

Escapement Monitoring

The weir will be operated with a live box for capturing fish. The weir will be visually inspected on a daily basis to ensure no fish can migrate upstream undetected. The gate to the live box will be opened daily at approximately 8:00 am and closed around 11:00 pm. Technicians will periodically check the live box and process all fish as quickly as possible to prevent impeding the migration.

All fish captured in the live box will be identified to species and tallied for the daily escapement counts. All Chinook salmon will be examined for an adipose fin clip and sexed based on external characteristics. Chinook salmon with intact adipose fins will be recorded as wild, and those with missing adipose fins will be recorded as hatchery-reared. Chinook salmon will be given an upper caudal fin clip to prevent double sampling in the event of a weir failure. All wild and hatchery-reared Chinook salmon ≤550mm (mid-eye-fork) will be tallied as jacks (ocean-age-1 males). Since jacks are easily identified by their distinct size range, they will be censused to allow us to assess our systematic ASL sampling methods and associated bias (Task 8).

Biological Sampling

During the July 3 through 31 escapement monitoring, Chinook salmon will be processed through the weir following the flow chart in Appendix A1 and will be sampled for ASL data using the following methods:

1. Age: three scales will be removed following the methods of Welander (1940) and as described in Appendix A2.

   If regenerated scales are present on the fish's left side in the preferred area, then the right side preferred area will be used as an alternate. Scale samples will be temporarily stored in pre-numbered containers. At the end of the day, scale samples will be mounted on gum cards with the first three scales (1^{st} sample) placed in the first column on the right side of the gum card in cell numbers 1, 11 and 21. All additional three-scale samples will be placed in appropriate column until the gum card is filled. **Prior to mounting, scales will be inspected to ensure they are clean and oriented correctly before drying.** Common problems encountered with inexperienced scale collectors are listed in Appendix A3. Scale cards will be labeled with species, date, location, card number, and name of sampler **before** collection. To prevent confusion, the same scale card will be used for both wild and hatchery-reared Chinook salmon. The cards will be numbered sequentially from 1 through 99.

   Gum cards will be impressed into cellulose acetate using a Carver press at 99ºC and 22,500 psi for approximately 2.5 min in the Homer ADF&G office. Scales will be read using a microfiche reader and aged with methods described by Mosher (1969). Before scales are aged, the reader will review a test set of 100 Chinook salmon scale samples that have been previously aged by readers and contain at least 50 samples of a known age (Appendix A4). The reader's ages will be compared to the previous age estimates and known ages. Ages that do not match will be reviewed and re-read. Once the reader ages are resolved and equal to the test set ages, then the reader will begin with the collected samples from this season. Age estimates will be produced without knowledge of size, sex, and other age estimates. Scale samples will be aged twice to estimate within reader precision. All scale samples that had conflicting ages for the two estimates will be re-aged to produce a resolved age which will be used for composition and abundance estimates.

2. Sex: will be determined by external physical characteristics, such as kype development, or a protruding ovipositor.

3. Length: measurements will be from mid-eye to fork (MEF) to the nearest 5 millimeters.

Sample Sizes

The sample sizes giving the desired precision of estimates of the proportion by age category for wild fish were calculated by combining a finite population correction factor (Cochran 1977) with the sample size determined under the assumption of multinomial sampling (Thompson 1987):

$$n = \frac{n_o}{1 + \frac{n_o - 1}{N}} (1 - R)^{-1} \tag{1}$$

where:

n_o	=	128 Chinook salmon (Thompson 1987) of target population, and
N	=	total number of Chinook salmon in the target population and
R	=	Proportion of unreadable scales.

For the period of July 3 through 31, the latest 3-year average (2010-2012) run of wild Chinook salmon to the weir is roughly 640. Assuming the run in 2013 is similar to this average, and assuming age cannot be estimated on 20% of the scale samples, sampling 134 wild Chinook salmon will allow us to meet the criteria stated in Objective 3.

Since age/sex composition of the wild Chinook salmon run may change over time, age and length sampling will be conducted every other day by applying a sampling rate to the cumulative wild Chinook salmon weir count since the last sampling event. To determine the wild Chinook salmon sampling rate, we anticipated the wild salmon run to be the average of the last three years (640) and therefore anticipate that our required sampling rate will be 0.209 (134/640). Runs over the last three years have been substantially lower than in previous years and using the run size data from this period will improve our chances of meeting our sampling goal. For each sampling event, the number of wild Chinook salmon that arrived at the weir on the previous day will be multiplied by the sampling rate (0.21) and rounded up to the nearest whole number. Sampling will start immediately in the morning when the live box is opened and wild Chinook salmon will be sampled continuously until the sample size is met.

Since the recent hatchery-reared Chinook salmon runs have been small, every hatchery-reared Chinook salmon will be sampled for age and length; we will therefore obtain a census of the age-sex composition of hatchery fish.

WATER TEMPERATURE AND DISCHARGE

Water temperature and discharge data will be analyzed post season. Cook Inletkeeper (CIK), a citizen-based nonprofit group, will collect water temperature (°C) every 15 minutes using a temperature logger, at their NR-2 site (described in Mauger 2005). The NR-2 site is located approximately 6.0 RKM above the weir site (Figure 2). Discharge data will be collected by the National Weather Service, Alaska Pacific River Forecast Center (RFC) near the Sterling Highway Bridge (RKM 0.9; Figure 2). RFC will contract a local citizen to collect a daily stage (ft.) reading at approximately the same time each day (~ 1900 hours) using a wire weight gauge. Collected stage readings will be converted to discharge in cubic feet per second (cfs) using a rating curve of previous discharge and stage measurements from the same Ninilchik River site.

River temperature (°C) and depth (nearest cm) will be measured twice daily at the weir site at approximately 1000h and 1900h. The measurements will be collected at a staff gauge installed downstream of the weir. A hand held thermometer will be used to measure water temperature. Temperature data collected at the weir will be used to monitor the environment of fish being held for broodstock collection. River stage measurements at the weir will allow for assessment of the river conditions and their potential influence on daily weir operation. Since more rigorous water temperature and stage data will be collected by other agencies, the water data collected at the weir will not be analyzed or reported further.

EGG TAKE

During July 3 through 31 escapement monitoring, an in-river holding area will be established using a weir upstream of the escapement weir to hold broodstock for gamete collection. It is likely that the 2013 wild Chinook salmon run will be below average and similar to the annual run sizes observed since 2009. To ensure meeting the SEG, the holding of wild Chinook salmon will be delayed until there is relative assurance of meeting the SEG. If we fail to meet the SEG no wild broodstock will be collected. Alternatively, all hatchery-reared Chinook salmon will be held for broodstock collection.

When we begin holding wild Chinook salmon, those fish showing signs of attaining more immediate sexual maturity will be placed in the holding area. The holding area will contain no more than 200 Chinook salmon at any given time and a 1:1 sex ratio will be maintained. Ripeness will be assessed on held females as often as necessary to ensure that they are spawned when ready. Small numbers (less than 10) of more mature Chinook salmon may be held in small (2 m^3) net pens within the holding area to reduce additional sorting and to prevent themspawning within the holding area before gametes can be collected. The daily number of wild and hatchery-reared mortalities from the holding area will be recorded.

Egg takes will be conducted when mature fish are available. Prior to 2012, eggtakes were conducted when sufficient numbers (at least 10 pairs) of Chinook salmon were ready to be spawned. In 2012, the low Chinook salmon run size resulted in a change in methods; 7 eggtakes were required to collect gametes from 27 pairs. If the Chinook salmon run size in 2013 is similar to 2012, mature Chinook salmon will be spawned as soon as they are ready. Ideally, every female hatchery-reared Chinook salmon will be spawned and as few as one pair of fish may be spawned in an egg take.

For each egg take, gametes will be collected at the weir site, but fertilization will be delayed until gametes reach the William Jack Hernandez Sport Fish Hatchery (WJHH) in Anchorage. Held fish will be captured with a seine and dip nets. Males and unripe females will be sorted into net pens. Ripe females will be sacrificed, placed on their back on an angled rack with their heads upward. After a female is placed on the rack, she will be bled (bled-out) by cutting the lower dorsal artery and vein by from the ventral side of their caudal peduncle to prevent blood from being mixed with the eggs. To collect the eggs, each bled-out female will be held above a container holding a sealable egg bag and then her abdomen cut open from the vent to the gill plate. Loose eggs will then be collected in the bag. Males will be randomly selected from the net pens. Immature males will be released upstream of the weir and mature males will be live spawned before they are released upstream of the weir. Each mature male will be live spawned into a sealable bag. Finally, the gametes will be packaged in a container chilled by ice packs and transported to WJHH by hatchery staff or will be shipped from Homer to Anchorage with an air courier.

Kidney samples will be collected from all sacrificed female Chinook salmon to test for BKD. A small spoon will be used to remove 2 small (1x1cm) pieces of kidney from the anterior and posterior ends of the kidney. The combined kidney samples per individual should weigh 1-2 g and will be placed in a whirlpak bag and labeled with the sample location, date and species. The spoon will be wiped clean of all tissue and disinfected with 3% iodophor solution (Betadine) between sampling each fish. All samples will be placed on ice and transported by hatchery staff to the pathology laboratory in Juneau.

Only wild Chinook salmon will be used to supplement the Ninilchik River. A combination of wild and hatchery-reared Chinook salmon will be used to stock the Kachemak Bay release sites. The head, length, and a scale sample will also be collected from all sacrificed hatchery-reared females for age validation (comparison with CWT data) and to detect straying. Gum cards for scale samples from fish collected during egg takes will be numbered sequentially starting with 201.

SMOLT RELEASES

The stocking of Chinook salmon smolt at the three terminal fishery locations in Kachemak Bay will be coordinated by Homer staff, hatchery staff, a barge operator, Seldovia City Manager, and Kachemak Bay State Park volunteers. Hatchery staff will independently arrange the direct release of approximately 50,000 Ninilchik River Chinook salmon smolt at the Brody Road bridge. In NDFL, approximately 210,000 Chinook salmon smolt will be stocked in two separate stockings of roughly 105,000 smolt each. Approximately 64,150 Chinook salmon smolt will be stocked in HCL and Seldovia in May or early June.

Smolt will be transported from WJH hatchery to the Homer Area with a tanker truck with either 5 or 6 separate tanks. Hatchery staff will ensure dissolved oxygen (DO), CO_2, and water temperatures are at appropriate levels for smolt. The tanker truck loaded with fish will be barged by a private contractor to HCL and will be ferried to Seldovia on the State of Alaska Marine Highway System Ferry.

Stocking

Release methods will vary by stocking location. Chinook salmon smolt will be released directly into the Ninilchik River at Brody Road bridge and allowed to emigrate freely. In Seldovia, Chinook salmon smolt will be directly released at the northern end Fish Creek Slough and allowed to freely emigrate to the harbor. The Seldovia stocking location is approximately 2 km from the bridge over the slough near the harbor. The slough has several small freshwater inputs and always has enough water to allow smolt to emigrate to the harbor even at low tide.

For stocking at NDFL and HCL, smolt will be held in net pens and fed for five days prior to release but only if *Chaetoceros spp.* concentrations are below 10,000 cells/L (see methods below in plankton sampling section). If *Chaetoceros spp.* concentrations are above 10,000 cells/L prior to stocking, smolt will be directly released at both locations.

We assume that a five day holding period is beneficial for Chinook salmon smolt to imprint to their stocking location. NDFL has no freshwater inputs and HCL has a small 2nd order stream approximately 0.2 km west of the stocking location. After the holding period, smolt will be released near high tide, which is particularly important at NDFL where access to saltwater is restricted below a tide height of 3.96 m.

The float net pens will be deployed in the deepest water available, in southwest corner of NDFL (Figure 4) and at the public dock in HCL. The float net pens at NDFL will consist of aluminum floats (8.5 m long, 0.6 m wide and 0.3 m tall) braced together with 2x6" boards and plywood walkways. The float net pens at HCL will consist of aluminum floats (7.3 m long, 0.6 m wide and 0.45 m tall) braced together with plywood walkways and have attachments for the nets to hang. At NDFL 2 nets (8.53 m long, 4.27 m wide and 3.66 m deep) will each provide approximately 133.3 m^3 of volume to hold smolt and another 2 nets having a width, depth and length of 3.7 m will each provide 50.7 m^3 of volume to hold smolt. At HCL, the 4 nets have a width, depth and length of 3.4 m and each provide 39.3 m^3 of volume to hold smolt. The nets will be attached to the inside of the braced floats. After smolt are stocked into the float net pens, each net pen will be covered with netting to reduce bird predation.

The NDFL float net pens will be anchored offshore on the ends of each float with large anchors in three corners and smaller anchors at the other locations. A running line will be placed at the non-anchored corner to allow Homer staff to access the float net pens using a skiff. Between stockings the nets will be removed and washed to improve water flow. A hose will be used to move the smolt from the stocking truck to the pens. An additional float will be used to support the hose across the open water between the pens and shore.

The HCL float net pens will be tied to the southeast corner at the public dock to the Kachemak Bay State Park Ranger Station. This will provide direct access to the float net pens for State Park volunteer staff. During stocking, the barge will be tied to the dock and the stocking truck will remain on the barge. A hose will run from the stocking truck to the float net pens.

At both NDFL and HCL, smolt will be stocked at a density of no more than 6 kg of fish/m^3. The estimated average weight per smolt will be used to calculate the appropriate number of smolt per pen and fish from each tank of the stocking truck will be divided equally among float net pens. For each stocking, if the density of Chinook salmon smolt using all smolt in the stocking truck is calculated to be greater than the maximum density (6 kg of fish/ m^3), the excess smolt will be directly released to open water. The approximate number of smolt will be recorded for each float net pen.

Holding Mortality Assessment

The daily number of mortalities will be enumerated for each float net pen each morning prior to feeding at NDFL and HCL. Mortality assessment will be conducted by Homer staff at NDFL and State Park Volunteer Staff at HCL. Dead smolt generally sink to the bottom of the net pen and will be counted by removing the net covers and pulling one side of each net pen to the surface. This action will typically float the dead smolt up to the surface where they can be captured using a long handle dip net. Once the majority of the dead smolt are captured, the net pen will be released as quickly as possible to allow smolt to disperse throughout the entire float net pen.

We assume that mortality should be the highest for the first day due to the stressors associated with transport to the stocking location. Although smolt are scheduled to be held for five-days, they will be released early if: 1) the daily mortality rate is $\geq$0.5%; or 2) the cumulative mortality rate is $\geq$1.0% from any given net pen.

Feeding

Smolt held at the NDFL and HCL, will be fed twice a day with Biomark smolt pellet food. At NDFL, the smolt will be fed in the morning (~9:00 am) by Homer staff after assessment of daily mortalities and by volunteers in the evening (~6:00 pm). State Park volunteers will follow the same schedule at HCL. Feeding can be done with the covers over the pens on.

Smolt will be fed 1-2% of their biomass per day. The number of Chinook salmon smolt and their average weight will be used to estimate the total biomass per net pen. A premeasured graduated container will be used to measure the feed.

The food will be dispersed by hand to each float net pen for each feeding and the amount of feed dispersed will be recorded at each feeding. The food will be slowly and evenly spread out across the entire float net pen to allow all fish to have access to the food and prevent food from not being eaten and settling on the bottom of the net and be wasted. Food will be dispersed among all of the float net pens during a feeding instead of feeding one pen at a time to speed up the process. If the smolt are not actively eating all of the food, then less food will be fed to reduce the amount of waste.

Plankton Sampling

Since 2009, holding salmon smolt at NDFL and HCL has been complicated by harmful algal blooms, specifically the diatom *Chaetoceros spp.* These diatoms are found as either individual cells or long chains of individuals linked together. Each individual has long spines that can lacerate the gill filaments of fish. Chinook salmon smolt held in pens are more susceptible to the harmful effects of *Chaetoceros spp.* since avoidance of the blooms by the fish is prevented. *Chaetoceros spp.* concentrations as low as 5,000 cells/L can be lethal to salmon held in net pens (Yang and Albright 1994). Plankton blooms are hard to predict but generally, blooms are influenced by amount of sunlight and inputs of inorganic nutrients such as nitrate and phosphate (NOAA, 2010). *Chaetoceros spp.* concentrations can increase quickly to levels unsafe to hold fish (>10,000 cells/L) and then to bloom-like levels (≥1,000,000 cells/ L).

In 2012, the risk of subjecting held smolt to lethal concentrations of *Chaetoceros spp.* necessitated assessment of daily concentrations throughout the stocking season. The goal was to identify changes in concentration levels of *Chaetoceros spp.* that would influence our ability to safely hold smolt in net pens. The assessment started prior to stocking on April 17 and initial *Chaetoceros spp.* concentrations were well below 10,000 cells/L but on April 28 (one day after stocking a small test group of Chinook salmon smolt), *Chaetoceros spp.* concentrations increased to bloom levels. *Chaetoceros spp.* concentrations remained higher than 10,000 cells/L throughout the monitoring period into early August when sampling was terminated. The exception to this pattern was a 5 day period from July 13 through 17 but after this period *Chaetoceros spp.* concentrations averaged 377,000 cells/L through August 5. Additionally, spatial variation in *Chaetoceros spp.* concentrations were also assessed at NDFL. *Chaetoceros spp.* concentrations were estimated at three different surface locations and also from near the bottom within NDFL and were compared to the standardized sampling location. *Chaetoceros spp.* concentrations were similar at all locations. The daily *Chaetoceros spp.* concentrations observed throughout the season were also compared to samples collected by Kachemak Bay Research Reserve and NOAA field station in Kasitsna Bay. Results were generally similar suggesting that *Chaetoceros spp.* was the predominant plankton species throughout Kachemak Bay and when blooms occurred within NDFL, they also occurred at other locations in the bay. Although there may be some spatial variation, our methods (i.e. limited non-spatial sampling) should be able to detect critical levels of *Chaetoceros spp.* with relative certainty.

In 2013, the daily *Chaetoceros spp.* concentration will be estimated for at least the two days prior to any stocking at NDFL and HCL and while any Chinook salmon smolt are being held in net pens. Additionally, as time allows, the concentration of *Chaetoceros spp.* will be estimated once weekly from mid-April through July. Since NDFL was dredged in November 2012, some additional samples will be collected from near the bottom and compared to surface samples to see if there is any stratification of *Chaetoceros spp.* within the water column.

To estimate the daily *Chaetoceros spp.* concentration, one surface water sample will be collected from the float net pens (outside of the nets) in the southwest corner of the lagoon during residual depth (<13 ft tide height). The primary water sample will be 1 L of unfiltered surface water. If the estimated *Chaetoceros spp.* concentration from the unfiltered sample is less than 30,000 cells/L, then a filtered method will be used to concentrate a volume of surface water such that a detectable number of cells occurs on the counting slide. An unfiltered 1L water sample will be collected at every sampling event and the need for a filtered sample will be determined based on previous sampling or the processing of the current unfiltered sample. For filtered samples, the smallest amount of water needed will be used to prevent filtration from crushing cells.

The filtered water sample (up to 400 L) will be collected by either using a bucket or a handheld electric bilge pump. The water sample will be filtered through a 20-micron plankton net. After the water sample has been filtered through the net, the net will be rinsed into a 150 ml sample bottle attached to the bottom of the net to ensure all plankton from the sample are in the 150 ml bottle. The 150ml sample bottle will be labeled with the date and taken to the Homer office for processing.

Water samples will be taken to the office and stored in a cooler until it has been processed. Prior to subsampling, the water sample will be homogenized by slowly rotating it (not shaken) for 30 seconds. After the water sample has been homogenized, a pipette will be used to collect a subsample from the middle of the sampling bottle. The subsample will be placed on a counting slide and a cover slip will be gently placed over the subsample to keep it within the counting slide.

Several methods may be used to count the number of cells of *Chaetoceros spp*. Based on relative precision criteria for plankton sampling, roughly 100 cells of *Chaetoceros spp*. need to be counted for each slide (Karlson et al. 2010). The primary counting method will be to count every *Chaetoceros spp.* cell present on an entire gridded Sedgewick-Rafter counting slide. The Sedgewick-Rafter counting slide holds exactly 1.0 ml of water and has 20 rows with 40 grids each. If the anticipated number of cells is greater than 100 cells of *Chaetoceros spp*. then subsampling of the slide rows may occur during the counting process. Different methods of subsampling the rows of Sedgewick-Rafter counting slide will be explored but they will always involve counting all grids within a row. When concentrations of *Chaetoceros spp*. in the lagoon are considered at bloom levels (~>1,000,000 cells/L; unfiltered samples only), a Palmer counting slide will be used. The Palmer counting cell holds exactly 0.1 ml of water and is not gridded so the entire slide should ideally be counted. If concentrations are too large to count every cell within the Palmer counting slide, then expansions based on area of field of view will be explored. Alternatively expansions based on counting a small portion of a Sedgewick-Rafter counting slide may also be considered.

In 2012, up to three replicate counts were made from the same water sample. The overall relative precision was 20% and decreased when *Chaetoceros spp.* concentrations were below bloom levels. As time allows in 2013, replicate counts will be done for each water sample. Ideally, a minimum of three counts will be produced for each day. The concentration of *Chaetoceros spp.* for each water sample will be calculated with appropriate dilution expansions based on filtering and/or counted slide volume.

Water Quality Monitoring

Water quality will be monitored at only NDFL due to the lack of equipment. Homer staff will use a YSI sonde to measure water temperature, salinity (ppt), and dissolved oxygen saturation (%) and concentration (mg/L). The sonde will be scheduled to automatically collect the data every 15 minutes and deployed within a float net pen approximately 1.8 m from the water surface. When the nets are removed for storage or cleaning the sonde will be deployed at a similar depth and location from the braced floats. Data will be downloaded between each stocking and the sonde will be recalibrated prior to redeployment.

COMPOSITION OF CHINOOK SALMON IN JULY SPORT FISHERY

Prior to the opening of the July hatchery-reared Chinook salmon sport fishery a beach seine survey will be conducted in the lower 2 miles of the Ninilchik River to assess the composition of the Chinook salmon run. In recent years, below average runs have complicated our ability to meet our escapement and eggtake goals. The composition of the run in the sport fishery area may suggest restricting the sport fishery to help meet goals. For example, in a year with an anticipated low escapement, finding a high proportion of wild fish in the river before the fishery may lead to closing the July sport fishery to fishing for Chinook salmon to reduce catch and release mortality of wild Chinook salmon and to provide additional hatchery-reared fish such that the eggtake goal is achieved.

One survey will be conducted during the last week of June and will start and at Garrison Ridge road and end just prior to the harbor. The beach seine will be deployed from shore or a small raft just upstream of where Chinook salmon are thought to be holding. Methods will be identical to the beach seine surveys conducted in 2008 (Booz and Kerkvliet 2011). Hatchery-reared Chinook salmon are easily identified by the absence of the adipose fin. We assume that most of the Chinook salmon run will be inriver and holding in this section of river during this survey and anticipate up to roughly 700 Chinook salmon present during this time. Based on the desired precision criteria for Objective 5 and using a finite population correction factor, the minimum sample size will be 62 Chinook salmon. Based on beach seine surveys conducted in 2008 and 2012, this sample size is easily obtainable. During the survey, the number of wild and hatchery Chinook salmon will be recorded each time the beach seine is deployed.

DATA COLLECTION

Escapement and biological data collected at the weir will be recorded onto datasheets (Appendix B1) and then entered in a field-specific Access database (e.g. 2013 Ninilchik Field Database.mdb; Appendix C1). Daily and cumulative fish counts and biological sample data will be automatically generated using queries and reports from this database (Appendix C2). Post-season, all data will be proofed before analysis begins.

NDFL and HCL smolt stocking data will be recorded onto datasheets (Appendix B2) and entered into Excel spreadsheets at the Homer office. Plankton data will be directly entered into an excel spreadsheet. Water quality data will be downloaded into Excel spreadsheets at the Kachemak Bay Research Reserve laboratory.

A backup copy of all data files will be saved on a jump drive at the end of each day. The data on the jump drive will be taken to the Homer office as often as possible during the field season. Scale cards will be examined for completeness, accuracy, and scale placement. All data files and forms will be reviewed for completeness and accuracy, by the biologist leading the fieldwork.

DATA MAP

All data will be appended to tables within an Access database (*NinilchikRiver_master.mdb*) for final editing and will be stored on the local network O-drive in the Homer office. All data will also be copied onto a DVD and archived in the Homer office. Additionally, all pertinent data files will be submitted to Research and Technical Services along with the final FDS report. These data files will be archived as RTS Publication archives and will be associated with the published report (as per MacClellan et al., 2012; page 20).

DATA ANALYSIS

Escapement

Annual escapement for 2013 for each of the wild and hatchery components will be calculated by removing the fish mortality associated with egg takes from the weir count.

Age, Sex and Length Data

Prior to 2010, the age-sex compositions were estimated for wild and hatchery-reared Chinook salmon from sampling rather than using the information present in the census of the sex composition. In some years, such as 2007, the sampling estimated more males than the census counted and biased age-sex estimates (Booz and Kerkvliet *2011b)*. The reason that males were over-selected when sampling is unknown. The selectivity could be a result of the method used to process fish in the live box, or because of differential behavior between males and females that influenced how they arrived at the weir, or the order in which they are processed in the live box.

In 2013, all hatchery-reared fish will be sampled for age and length, therefore eliminating any selectively bias. To reduce bias associated with possible sex selective sampling for wild fish, the age-sex composition estimates will be calculated by incorporating the known sex composition, as described in equations 2 through 12 below. (Point estimates described in equations 2-12 will be used for hatchery fish).

For the wild Chinook salmon run, the proportion by sex to the weir is known and will be calculated as:

$$p_i = \frac{x_i}{N} \tag{2}$$

where:

x_i = number of wild fish of sex class *i* in *N*,

N = run of wild fish to the weir

The proportion of wild fish of age *j* given sex *i* will be estimated:

$$\hat{p}_{j|i} = \frac{x_{ij}}{n_i} \tag{3}$$

where:

x_{ij} = number of wild fish of age class *j* in n_i,

n_i = number of fish of sex class *i* in wild fish sampled for age

with variance estimated as:

$$\text{var}(\hat{p}_{j|i}) = \frac{N_i - n_i}{N_i} \frac{\hat{p}_{j|i}(1 - \hat{p}_{j|i})}{n_i - 1} \tag{4}$$

Abundance of wild fish of age *j* given sex *i* will be estimated:

$$\hat{N}_{j|i} = \hat{p}_{j|i} N_i \tag{5}$$

with variance estimated as:

$$\text{var}(\hat{N}_{j|i}) = N_i^2 \,\text{var}(\hat{p}_{j|i}) \tag{6}$$

The proportion of wild fish in age class *j* and sex class *i* in the wild weir run will be estimated as:

$$\hat{p}_{ji} = \frac{\hat{N}_{j|i}}{N} \tag{7}$$

with variance estimated as:

$$\text{var}(\hat{p}_{ji}) = \frac{1}{N^2} \text{var}(\hat{N}_{j|i}) \tag{8}$$

The abundance of wild fish in age class *j* in the wild run will be estimated by summing over sex *i*:

$$\hat{N}_j = \sum_{i=1}^{2} \hat{N}_{j|i} \tag{9}$$

with variance estimated as:

$$\text{var}(\hat{N}_j) = \sum_{i=1}^{2} \text{var}(\hat{N}_{j|i}) \tag{10}$$

The proportion of wild fish in age class *j* in the run will be estimated as:

$$\hat{p}_j = \frac{\hat{N}_j}{N} \tag{11}$$

with variance estimated as:

$$\mathrm{var}(\hat{p}_j) = \frac{\mathrm{var}(\hat{N}_j)}{N^2} \tag{12}$$

The within-reader variability of scale age estimates will be calculated using a coefficient of variation (CV) expressed as the ratio of the standard deviation over the mean age (Campana 2001):

$$CV_j = 100\% x \frac{\sqrt{\sum_{i=1}^{R} \frac{(X_{ij} - X_j)^2}{R-1}}}{X_j} \tag{13}$$

where:

X_{ij}= the ith age estimate of the *j*th fish

X_j= the mean age estimate of the *j*th fish

R= the number of times each fish is aged

For each sex, age, wild and hatchery-reared group, the CV_j's will be averaged across all fish (*j*) in the group to produce a mean CV.

Plankton Concentration

Plankton concentration (k) for a given day in NDFL in cells/L will be estimated daily as:

$$\hat{k} = \frac{\sum_{i=1}^{D} c_i \rho}{D} \tag{14}$$

where,

c_i	=	Count of *Chaetoceros spp. from* counting cell for ith daily sample (D total samples per day, up to three)
ρ	=	Expansion factor accounting for counting slide sub-sampling (1.0 if all cells are counted) and volume-based adjustments (e.g slide volume, filtering)

Variance of $\hat{k}$ will be estimated as:

$$\mathrm{var}(\hat{k}) = \rho^2 \frac{s^2}{D} \tag{15}$$

where s^2 is the sample variance of the c_i. It is noted that the variance in equation 15 pertains to within-sample variability, and does not reflect variability across the lagoon, which is assumed relatively small, based on spatial sampling results from 2012.

Composition of Chinook Salmon in July Sport Fishery

The percentage of hatchery-reared or wild Chinook salmon in the river below the weir at the time of sampling will be estimated as a binomial proportion (Cochran 1977) by:

$$\hat{p}_j = \frac{n_j}{n} \tag{16}$$

with subscript *j* representing wild or hatchery-reared. The variance will be estimated as:

$$\text{var}(\hat{p}_j) = \frac{\hat{p}_j(1-\hat{p}_j)}{n-1} \tag{17}$$

SCHEDULES AND DELIVERABLES

Crew schedules from late June through August 3 are outlined in Appendix D1.

Date	Activities
April 1	Begin arrangements for saltwater smolt releases
April 15	Begin equipment preparation for saltwater smolt releases
May 6-20	Ninilchik weir preparation and install weir
June 24-June 28	Beach seine downstream of Garrison Bridge
July 1– August 4	Ninilchik weir operation
May 20 - June 30	Fresh and saltwater smolt releases
July 21 – August 3	Ninilchik River egg takes
August 5-August 9	Breakdown and store Ninilchik weir and camp materials
September 15 – October 15	Read scales and preparation of FDS Report
October 15 – February 15	FDS Reporting
October 1 – May 15	Correction of Federal Aid report and operational planning

Results of this study will be reported as an Alaska Department of Fish and Game, Sport Fish Division, Data Series report.

RESPONSIBILITIES

List of Personnel and Duties

Carol Kerkvliet, Fishery Biologist II, Project Leader- Duties: Oversees project by supervising operational planning, analysis, and reporting. Tracks implementation of operational plan and reporting and maintains daily contact with the field project leader. Prepares and tracks budget, hiring and supervising of crewmembers. Maintains contact with the field crew, providing assistance and direction when needed, overseeing daily reporting and summarization of data. Processes required land leases. Responsible for annual Federal reporting requirements.

Michael Booz, Fishery Biologist I, Field Project Leader- Duties: Drafts operational plan and annual report with oversight from project leader. Leads field crews. Provides necessary level of training, assistance and direction to the crew when needed. Completes routine administrative duties such as reviewing time sheets and approving leave. Maintains daily contact with the field crew. Routinely visits with the crew to observe activities, provide assistance, and discuss weir and stocking operation and sampling. Responsible for leading crew with the installation, maintenance and dismantling of the weir and stocking equipment. Responsible for summarizing season data, aging scales, and inseason escapement counts. Coordinates stocking with hatchery personnel and barge operators and eggtakes with hatchery staff and volunteers. Conduct eggtakes.

Jon Kee, Fishery Technician III- Duties: Leads the installation, maintenance and dismantling of float net pens for stocking and leads the transporting, feeding and release of smolt. Assesses daily mortalities of held smolt, collects and counts plankton samples, and communicates status of stocking with project leader, field project leader and hatchery staff. Assists with installation and dismantling of fish weirs and conducting eggtakes. Responsible for the installation and operation of the in-stream video equipment. Counts and summarizes daily escapement during in-stream video weir operation. Conduct eggtakes.

Marge Tillion, Fishery Technician II- Duties: Install, maintain, operate, and dismantle float net pens for stocking. Transport, feed, release and assess mortality of smolt. Collects plankton samples. Install, maintain and dismantle fish weir. Responsible for the daily operation of the weir. Collects ASL samples as outlined in the operational plan. Counts and summarizes daily escapement during in-stream video weir operation. Conduct eggtakes.

Holly Dickson, Fishery Technician II- Duties:. Install, maintain and dismantle fish weir. Responsible for the daily operation of the weir. Collects ASL samples as outlined in the operational plan. Counts and summarizes daily escapement during in-stream video weir operation. Conduct eggtakes.

Tim Blackmon, Fishery Technician III- Duties: Assists with installation and dismantling of float net pens and fish weir. Collects plankton samples. Responsible for the collection and processing of the water quality data. May assist with the transport, feeding, assessing daily mortalities and release of smolt. Counts and summarizes daily escapement during in-stream video weir operation. Conduct eggtakes and is responsible for the shipment of gametes to hatchery staff.

Kelsey Kleine, Fishery Technician III- Duties: Assists with installation and dismantling of float net pens and fish weir. Collects plankton samples. Assists with the installation and operation of in-stream video equipment and counts and summarizes daily escapement during in-stream video weir operation. Conduct eggtakes.

BUDGET

Projected FY2013:

Line Item	Category	Budget ($K)
100	Personal Services	79.3
200	Travel	1.0
300	Contractual Services	14.5
400	Commodities	4.3
500	Equipment	0
Total		103.9

Budget Manager: Carol Kerkvliet

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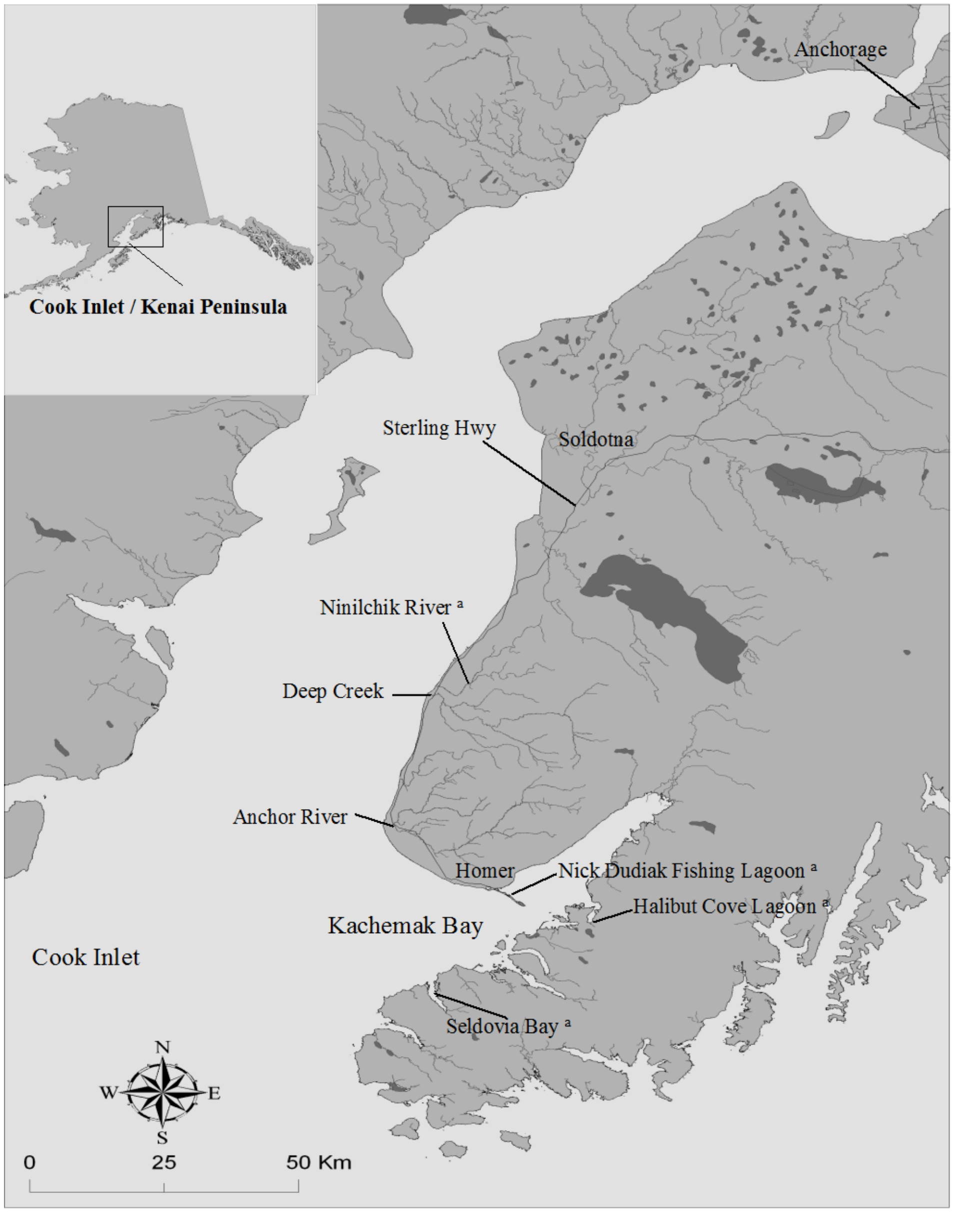
TABLES

Table 1.–Number and escapement of wild and hatchery-reared Chinook salmon counted at the Ninilchik River weir during SEG index monitoring period, 1999–2012.

	Wild Chinook Salmon					Hatchery Chinook Salmon				
	Total Run		SEG Period		SEG	Total Run		SEG Period		SEG
Year	Weir Counts	Escapement Counts	Weir Counts	Escapement Counts	Escapement Percentage of Total	Weir Counts	Escapement Counts	Weir Counts	Escapement Counts	Escapement Percentage of Total
1999	1644	1,576	1,351	1,283	81.4	641	573	515	453	79.1
2000	1634	1,553	1,346	1,265	81.5	853	685	786	626	91.4
2001	1414	1,239	1,072	897	72.4	673	543	601	483	89.0
2002	1516	1,340	1,073	897	66.9	559	395	403	266	67.3
2003	1258	1,127	648	517	45.9	425	336	293	217	64.6
2004	1525	1,393	811	679	48.7	536	469	409	373	79.5
2005	2241	2,076	1,424	1,259	60.6	462	409	339	295	72.1
2006	ND	ND	1,114	1,013	-	ND	ND	260	192	-
2007	ND	ND	672	543	-	ND	ND	83	63	-
2008	ND	ND	721	586	-	ND	ND	83	63	-
2009	ND	ND	551	528	-	ND	ND	97	65	-
2010	ND	ND	605	605	-	ND	ND	34	34	-
2011[a]	ND	ND	761	668	-	ND	ND	52	25	-
2012[a]	ND	ND	561	555	-	ND	ND	65	52	-

[a] preliminary.



[a] Stocking locations for Ninilchik River Chinook Salmon broodstock

Figure 1.-Map of Kenai Peninsula highway system, Ninilchik River and Kachemak Bay Chinook salmon stocking locations, 2013.

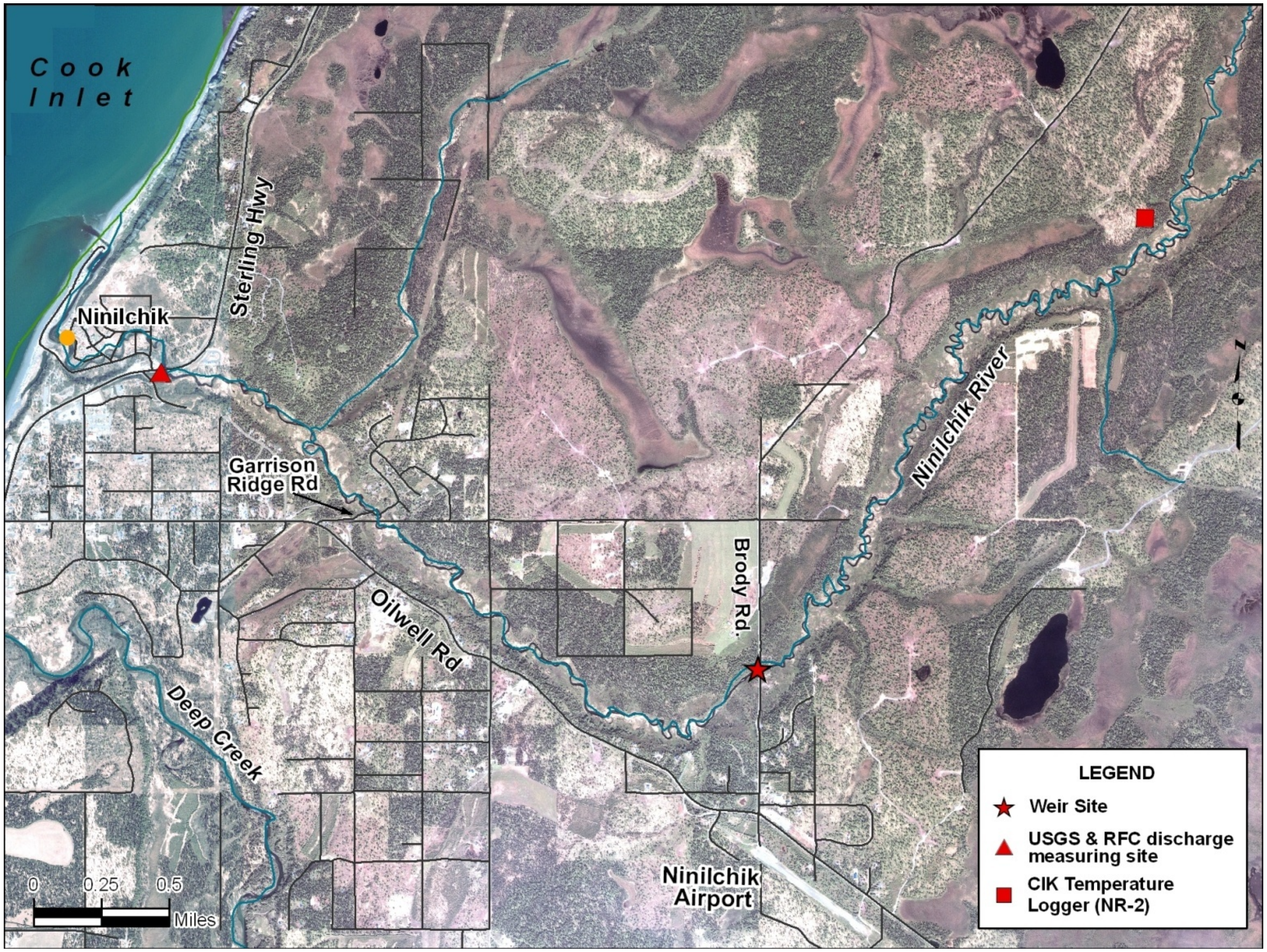


Figure 2.-Map of Ninilchik River sampling locations, 2013.

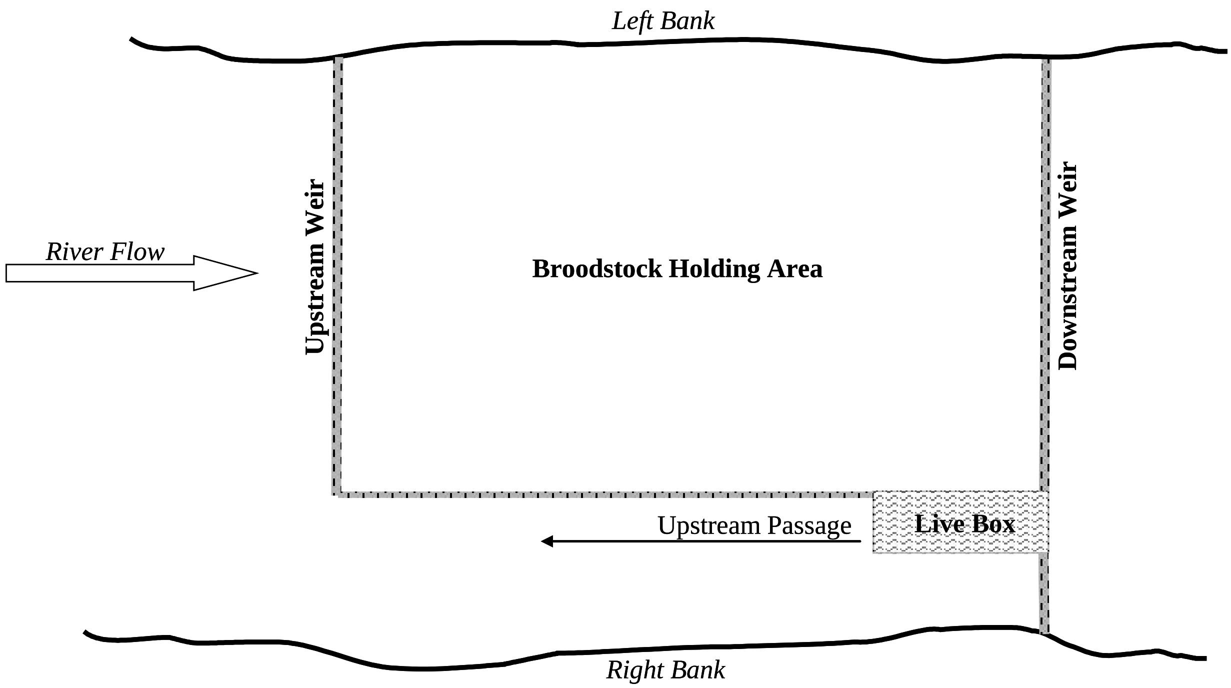


Figure 3-.The configuration of the Ninilchik River weir, 2013.

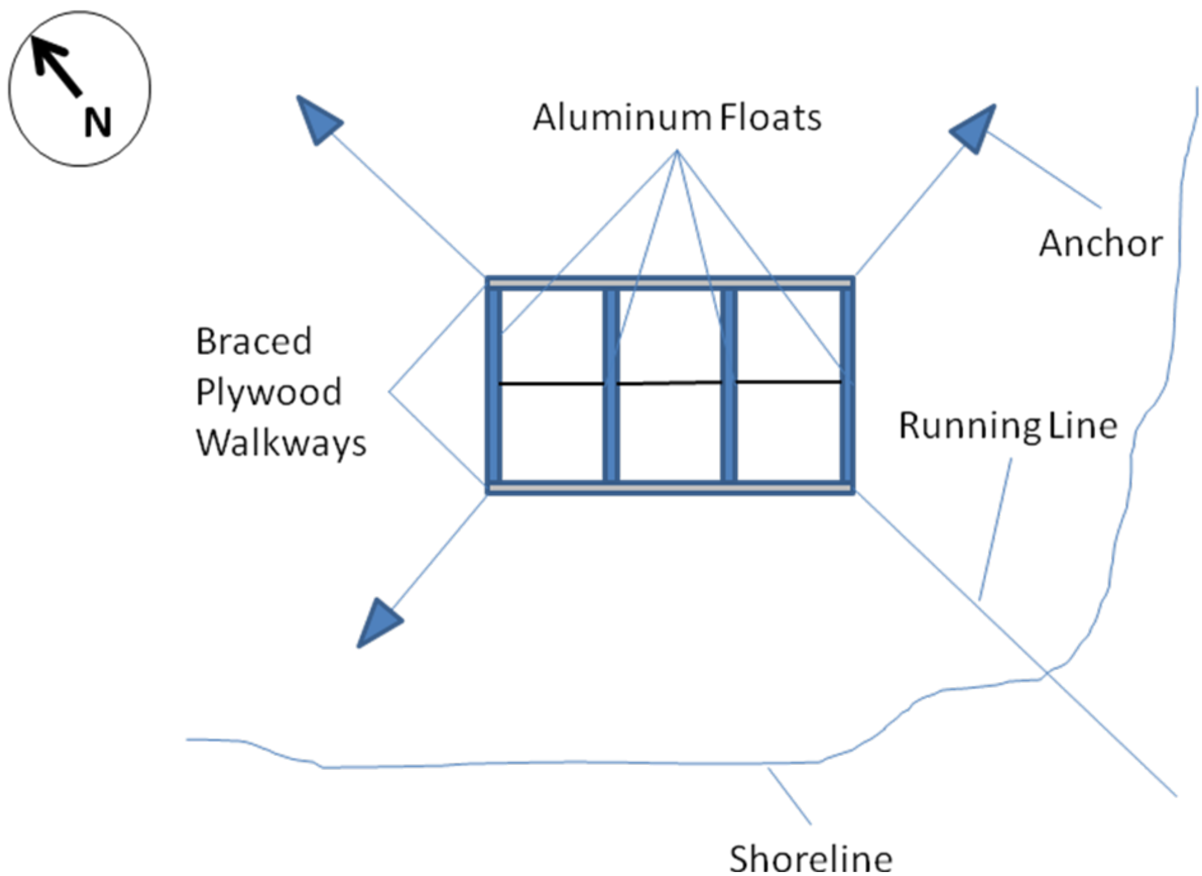


Figure 4-.The configuration of the stocking float net pen assembly at the Nick Dudiak Fishing Lagoon, 2013.

APPENDIX A.

CHINOOK SALMON PROCESSING AND SAMPLING PROCEDURES

Appendix A1.- Chinook processing flow chart at the Ninilchik River weir, 2013.

Caudal Clip

<u>Present</u>
Record as recapture
Pass upstream

<u>Absent</u>
Clip upper lobe

Adipose Fin

<u>Present</u>
Record as Wild
collect 3 scales & Measure MEFT every other day with sampling rate of 0.209

<u>Absent</u>
Record as Hatchery
collect 3 scales & Measure MEFT on every fish

Sex

Every fish based on external charactristics
Record as Male or Female

Jack

<u>≤ 550 MEF</u>
Yes

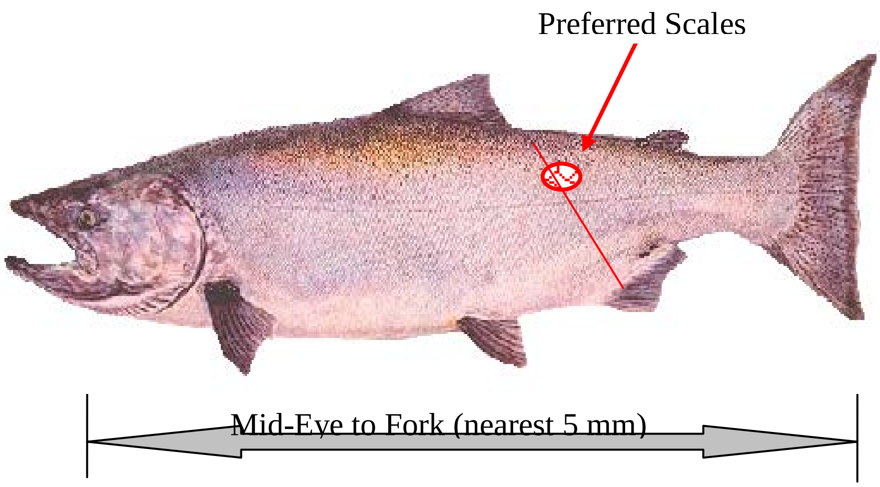
<u>> 550 MEF</u>
No

Pass Upstream or hold

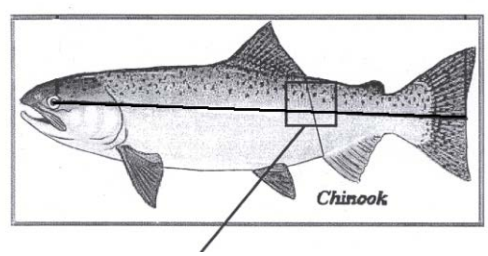
Minimize handling stress by:

- Prevent a large number of fish from entering the live box at one time
- Do not remove fish from water unless necessary
- Use net and sampling cradle to control fish
- Process each fish as quickly as possible
- Provide recovery area for fish released upstream

Appendix A2.- Scale and length sample procedures, Ninilchik River 2013.

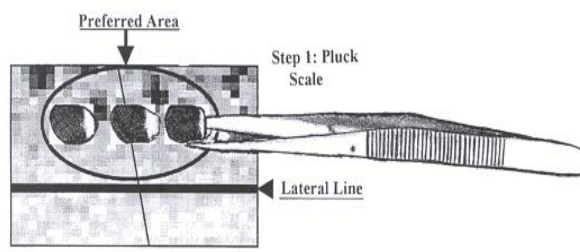


Preferred scales are located on the left side of the fish, two rows above the lateral line along a diagonal line from back (posterior) of the dorsal fin to the front (anterior) of the anal fin.



Pull the "preferred scale" from the fish using forceps.

Pliers may be necessary to remove scales if the fish has been in freshwater for an extended period.



A good scale has a well-rounded shape.

Hold scale up to light and examine for overall size, shape, regeneration, deformities, etc.

-continued-

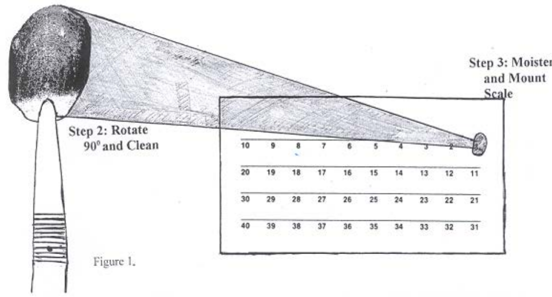
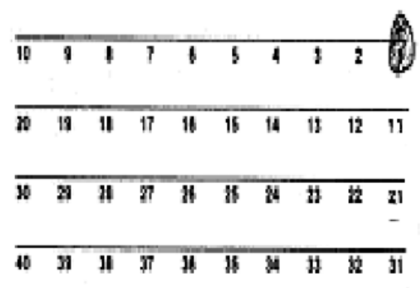


Figure 1.

Remove all slime, grit, and skin from scale by rubbing between thumb and forefinger. Place scales in the pre-numbered container. One set of three scales per fish per collection.

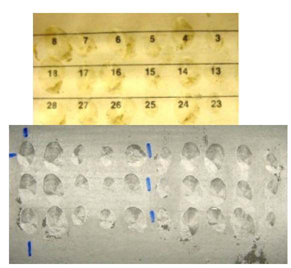
At the end of the day, mount the scales from each collection onto the gum cards. When mounting, be careful not to invert the scale and try to mount the insertion point up.



Gum cards are numbered from right to left. One fish per column and 10 fish per gum card.

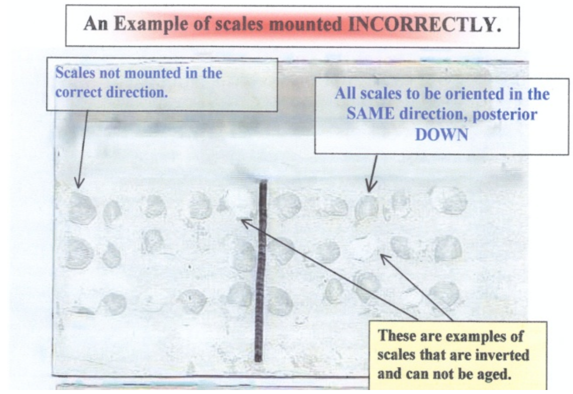
After mounting every collection of scales for the day, Attach a piece of wax paper over the gum card with a paper Clip. Store the gum cards in a Ziploc bag and send them to the Homer office as soon as possible.

At the Homer office, the gum cards will be pressed onto an acetate.

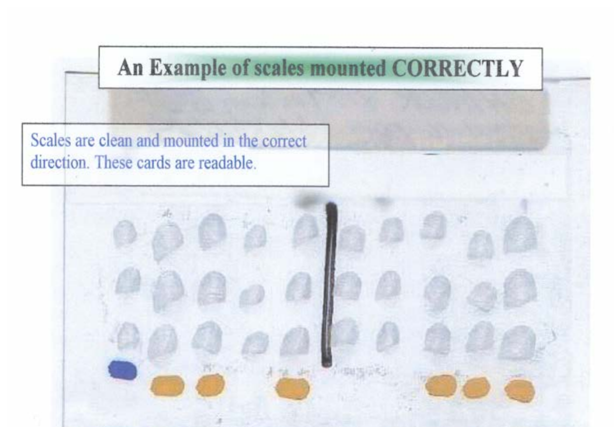


-continued-

Incorrect scale mounting



Correct scale mounting



Appendix A3.- Age sampling problems.

Common problems encountered with inexperienced scale collectors are: torn edges, inadequate scale cleaning, selecting regenerated or distorted scales, inverted scale mounting, and dirty gum cards. Common data recording errors include: recording the wrong origin (wild/hatchery), scale number for sample, incorrect number of scale samples collected than recorded data, and more than one fish with the same collection number. Experienced staff must take extra measures to ensure that less experienced staff become fully proficient at sampling before the first sampling event. Before the first sampling event, the experienced staff will take one fish and slowly walk through the sampling routine with less experienced crew. This routine should specifically demonstrate how to:

- Locate the lateral line and preferred scale sampling area;
- Identify irregular scale patterns that are the result of regenerated scales;
- Remove the scales in a manner that reduces torn edges;
- Properly clean and mount scale samples;
- Identify inversely mounted scales.

Minimize the handling of gum cards and keep them as dry as possible. Wet gum cards should be dried out slowly. Excessive heat when drying may cause the scale to become unglued from the gum card. After the gum cards are dry they should be stored with wax paper between each gum card. Check the numbering between the Access database and the gum card.

A final step to improve quality is to identify sampling problems promptly so that corrections can be implemented in season. To achieve this, gum cards should be sent to the Homer office as quickly and as often as possible throughout the season. The person actually collecting the scales needs to be identified on each gum card so feedback can be effectively directed to the source.

Appendix A4.- Scale Interpretation training and refresher procedure.

Reader Verification:

Readers will review a test set of 100 scale samples from both wild and hatchery-reared Chinook salmon collected from 1999 through 2007 at the weir. At least 50 scale samples within the test set will be of a known age and the test set will include samples of all ages.. Readers' test set ages will be compared to previous age estimates and known ages. Ages that do not match will be reviewed and re-read. Once the reader ages are resolved, then the reader will begin with the collected samples from this season.

Scale Interpretation and Criteria:

To estimate scale age, at least one scale per sample must have all of the following characteristics:

- A clean focus.
- Little or no regeneration in the freshwater growth area.
- Minimal tearing on the edge.
- Clearly identified annuli through winter growth periods and crossing over of rings.

If none of the scales in a sample contains all of these characteristics then the age will be recorded as "NR" (not readable). If differing scale age estimates are obtained within a scale sample, the age for that fish will be recorded as "NR".

APPENDIX B.
DATA ENTRY FORMS

AppendixB1.- Weir escapement data entry form, 2013.

Ninilchik River weir Fish Data Entry Form

Date: Crew: Page: of

Chinook salmon Data

#	Hour	Adfin (W/H)	# of fish	Sex (M/F/U)	Jack (Y/N)	Fate Up/Held/mort	Caudal (U/L/N)	Recap (Y/N)	Sampling data: Length MEFT (mm)	Sampling data: Scales Card	Sampling data: Scales Col	Sampling data: Genetics Vial #	Sampling data: CWT	Comments
1														
2														
3														
4														
5														
6														
7														
8														
9														
10														
11														
12														
13														
14														
15														
16														
17														
18														
19														
20														

Other Species Tally

Pink salmon	dolly varden	coho salmon	chum salmon	Sockeye salmon	Steelhead Trout

AppendixB2.- Stocking data entry form, 2013.

Stocking Data Entry Form

Location ________________ Stocking Date ____________________________ Page________ of________

Species Number of smolt Avg. Weight

Pen Number				
Number of smolt ________________		Release Date ____________	Max food per feeding ______________	
0.5% Est.		1.0% Est.		
		Amount of Food		
Day	Morts	Morning	Evening	Comments
1				
2				
3				
4				
5				

Pen Number				
Number of smolt ________________		Release Date ____________	Max food per feeding ______________	
0.5% Est.		1.0% Est.		
		Amount of Food		
Day	Morts	Morning	Evening	Comments
1				
2				
3				
4				
5				

Pen Number				
Number of smolt ________________		Release Date ____________	Max food per feeding ______________	
0.5% Est.		1.0% Est.		
		Amount of Food		
Day	Morts	Morning	Evening	Comments
1				
2				
3				
4				
5				

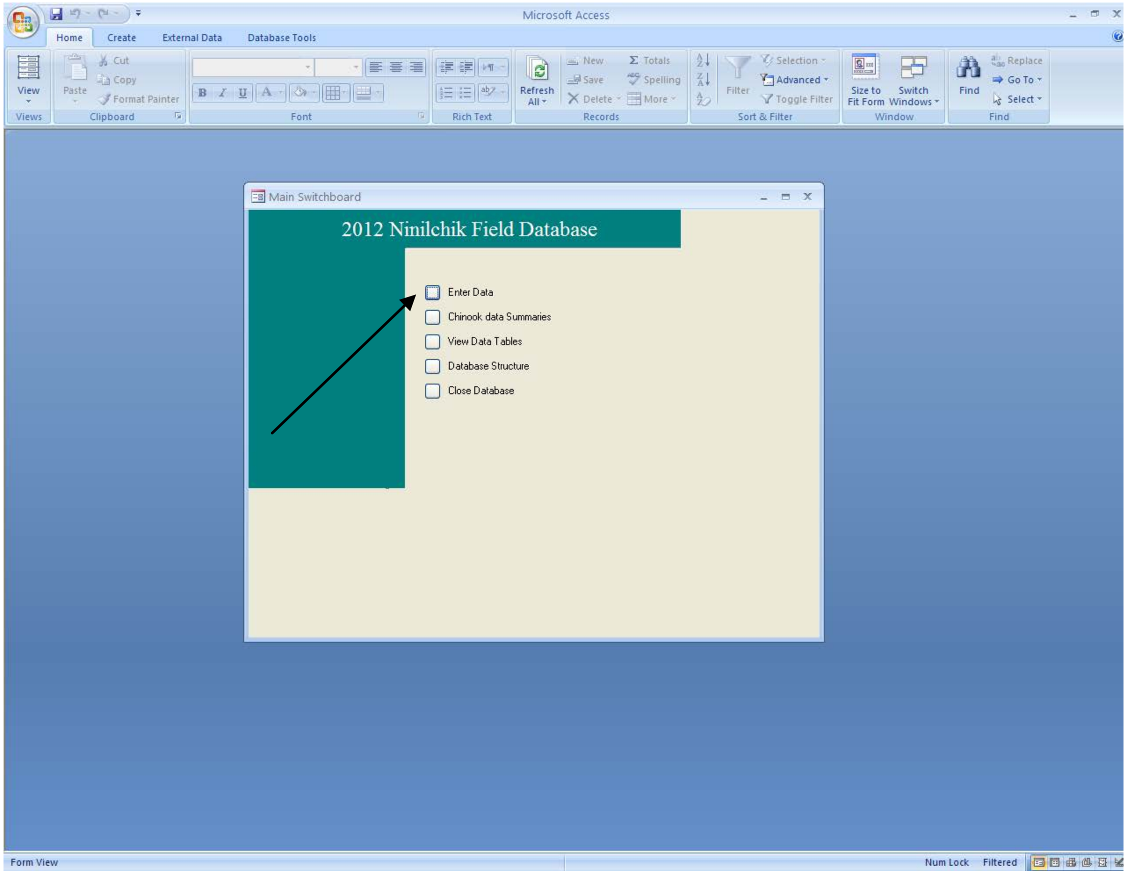
Pen Number				
Number of smolt ________________		Release Date ____________	Max food per feeding ______________	
0.5% Est.		1.0% Est.		
		Amount of Food		
Day	Morts	Morning	Evening	Comments
1				
2				
3				
4				
5				

APPENDIX C.
DATA PROCESSING OF WEIR DATA

Appendix C1.- Steps used to enter weir data from the form to an Access database.

Step1: Open Database.

The title of the database will be *“2013 Ninilchik Field Database”*.



When the database is opened, the switchboard automatically opens. To enter data, click on the “enter data” button.

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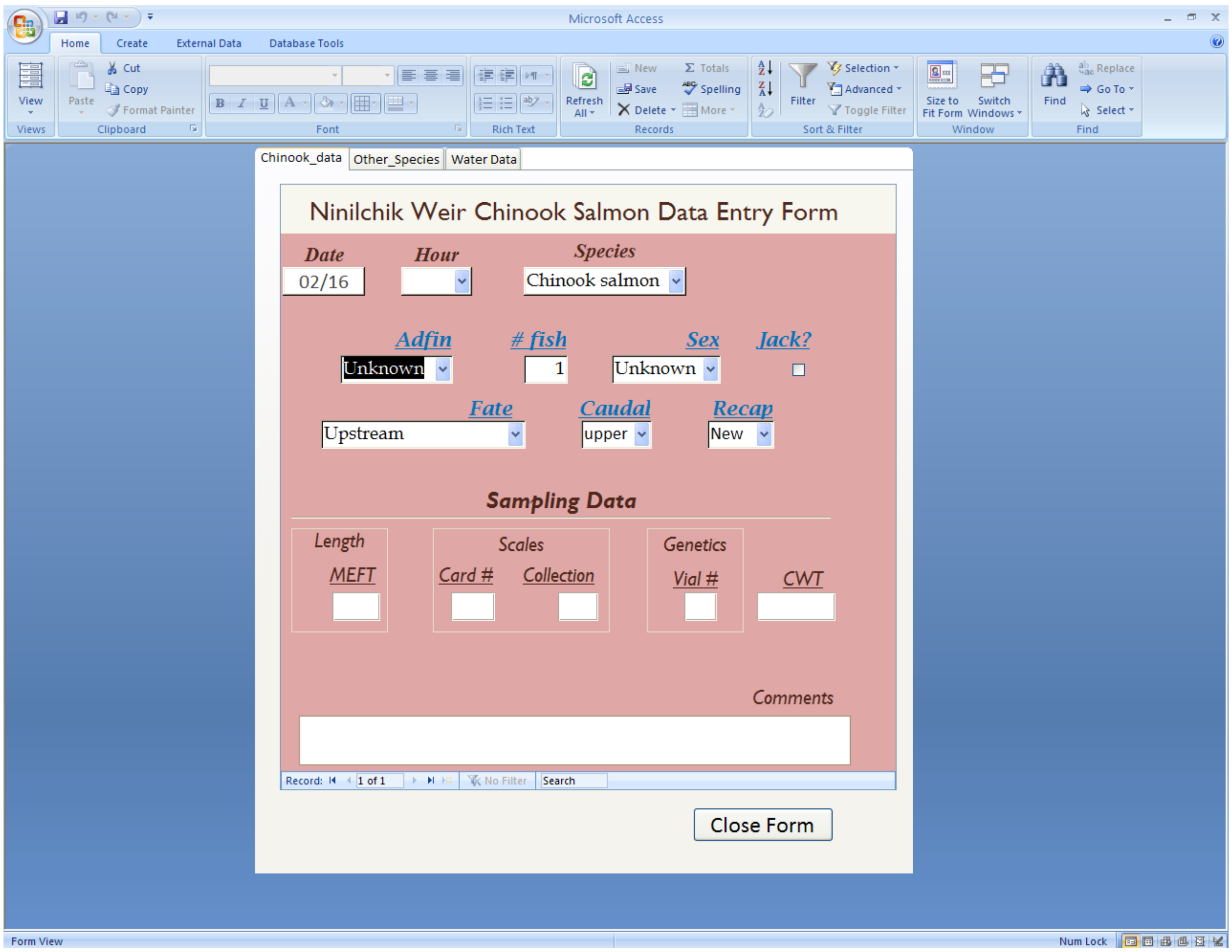
The data entry form will open. There are three tabs at the top of the form: 1) Chinook_data, 2) Other_Species, and 3) Water_Data. The Chinook_data form will be the default entry form and is visible first. To switch to other tabs just click them at the top of the form.



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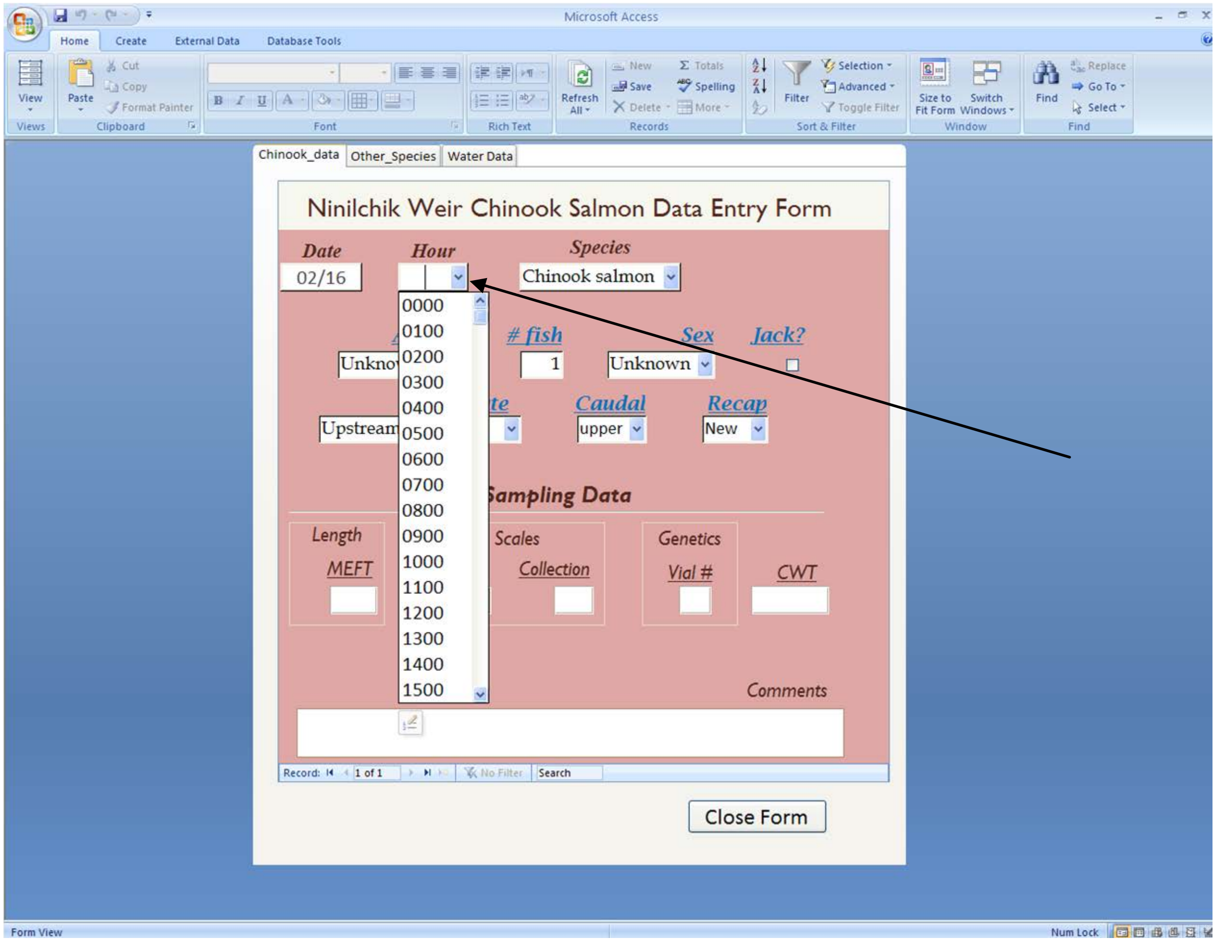
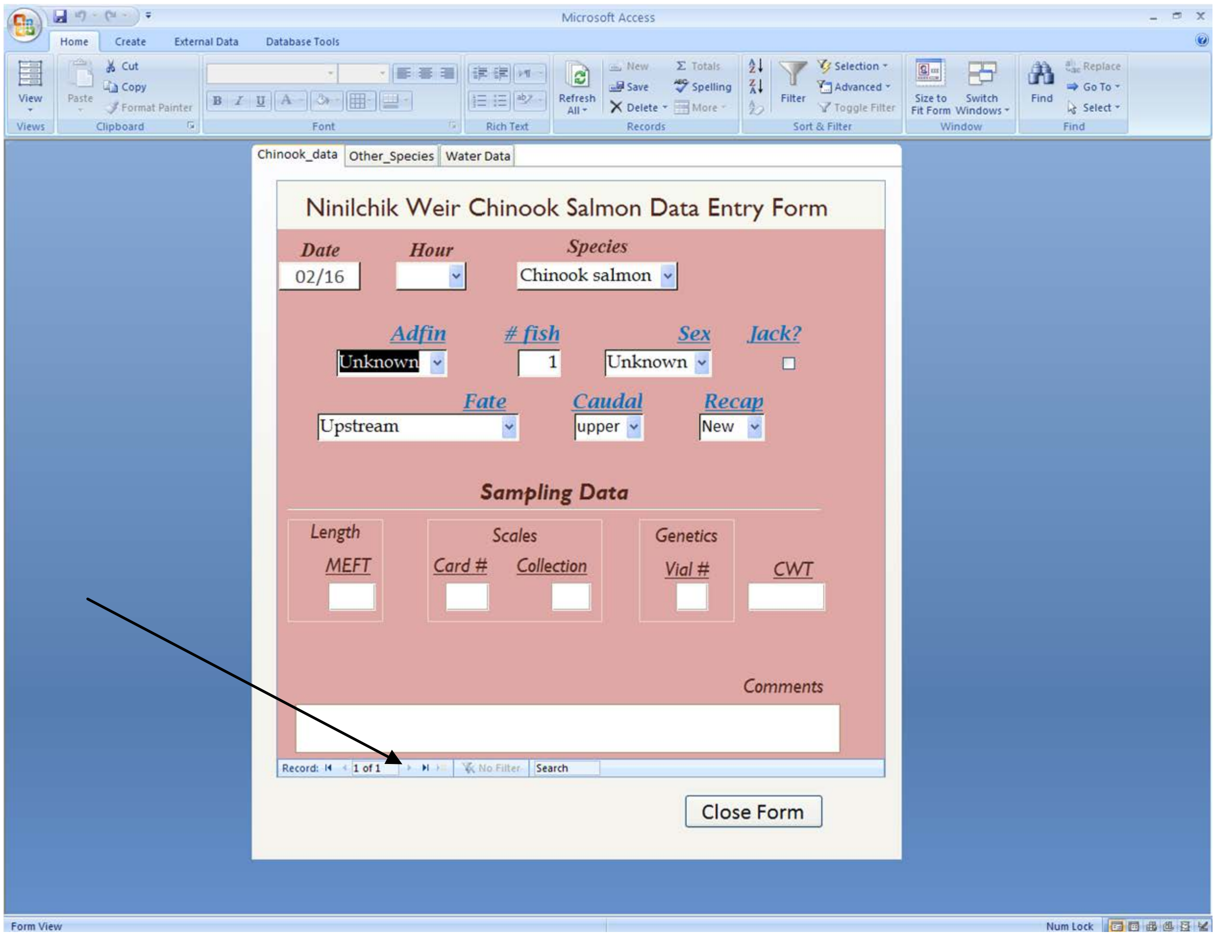
Step2: Enter Chinook Data.

Fill in the form sequentially.



-continued-

After you have entered all of the data for a record, you need to advance to the next record by pressing the *"next record"* button at the bottom of the form.



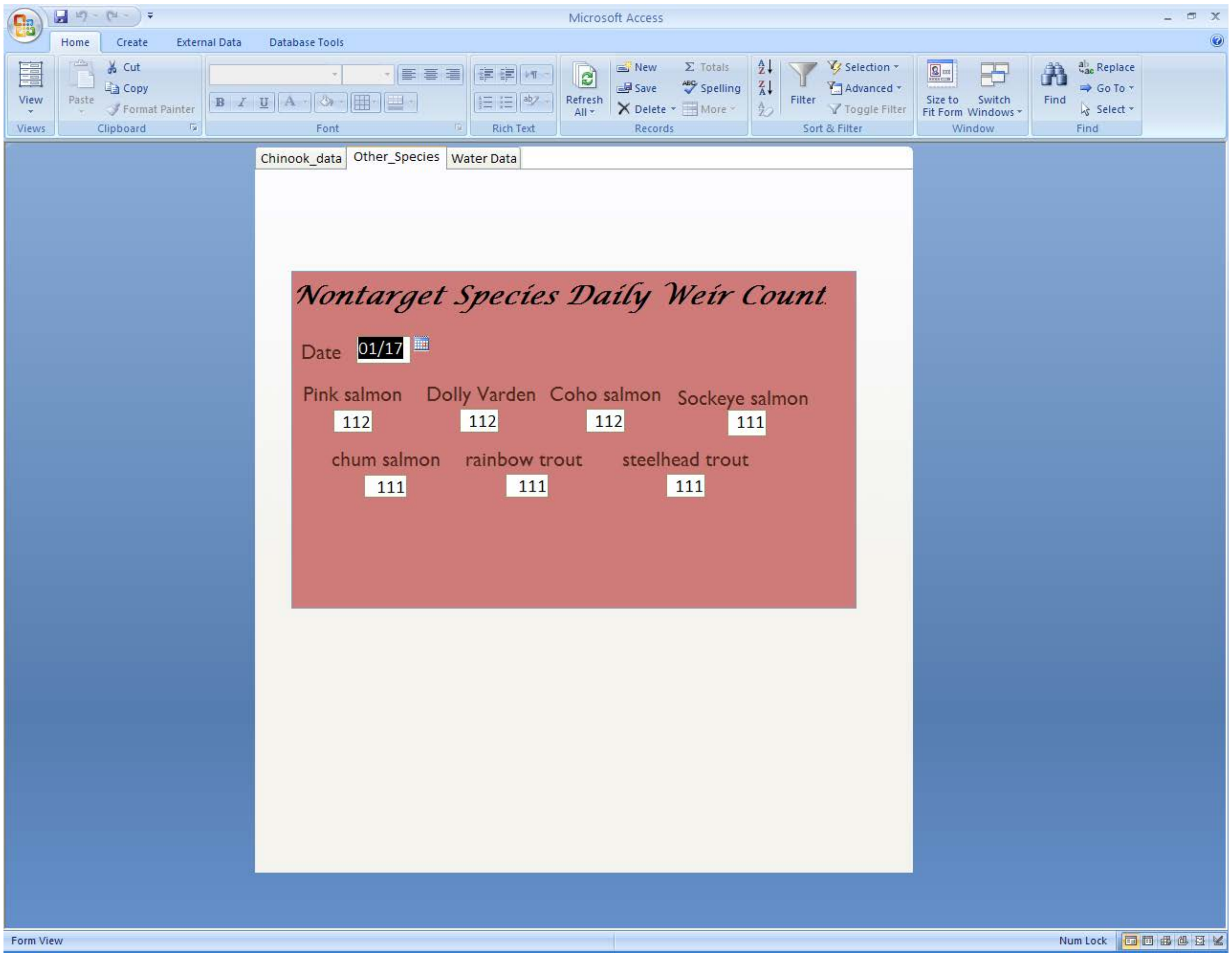
After all Chinook salmon data records have been entered, you can either press the *"close form"* button or move to the "Other_Species" or "Water_Data" tabs. If you do enter data in other tabs before closing the form, make sure you press the *"close form"* button before closing the database. There are several update functions that occur when you use the button.

The next time that you open the form there will be no data in the form. So prior to closing the form you can proof the data for each record by viewing them from the record selector.

-continued-

Step 3: Enter other species data

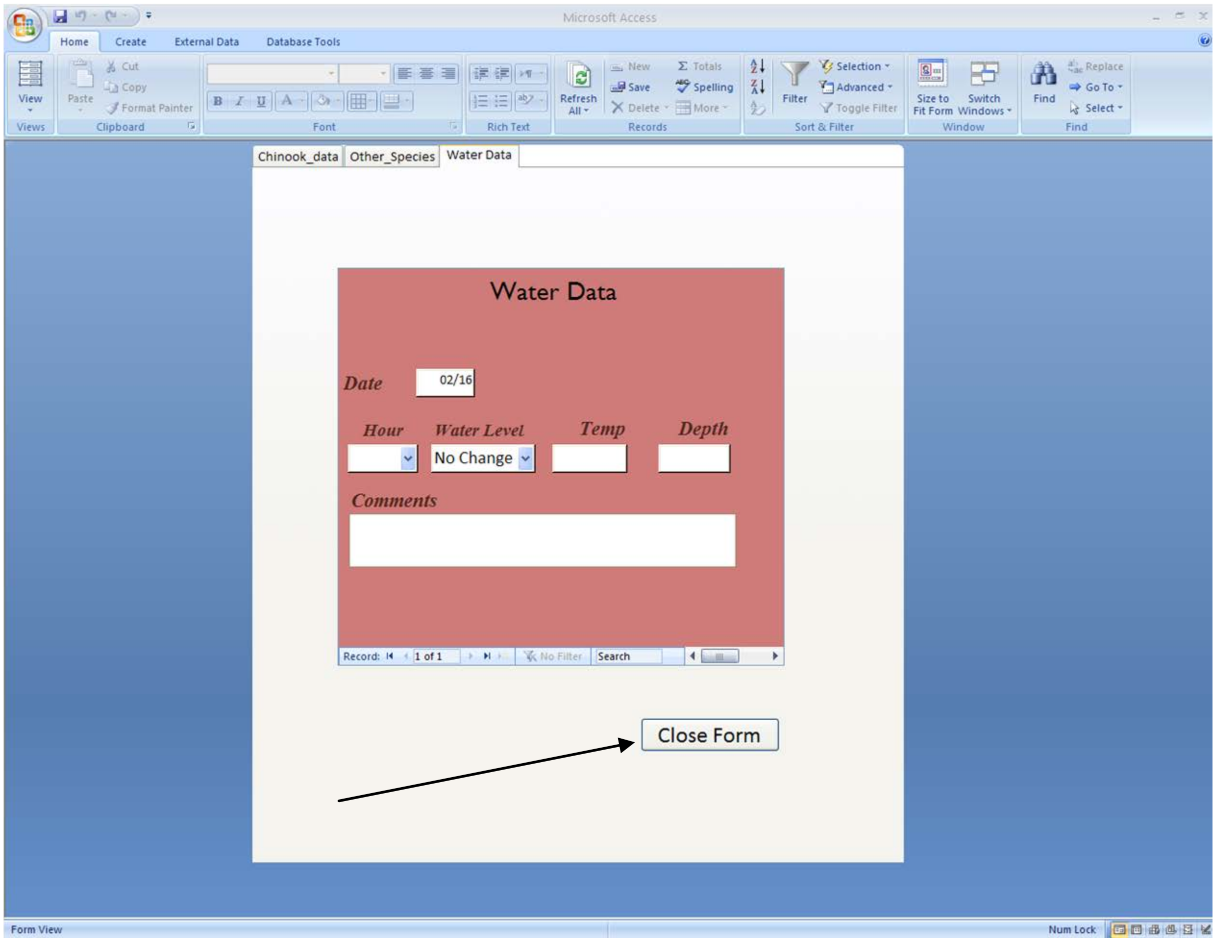
Click on the “Other_Species” tab. You will need to summarize the total number of each species for the day prior to entering the data.



-continued-

Step 4: Enter Water data

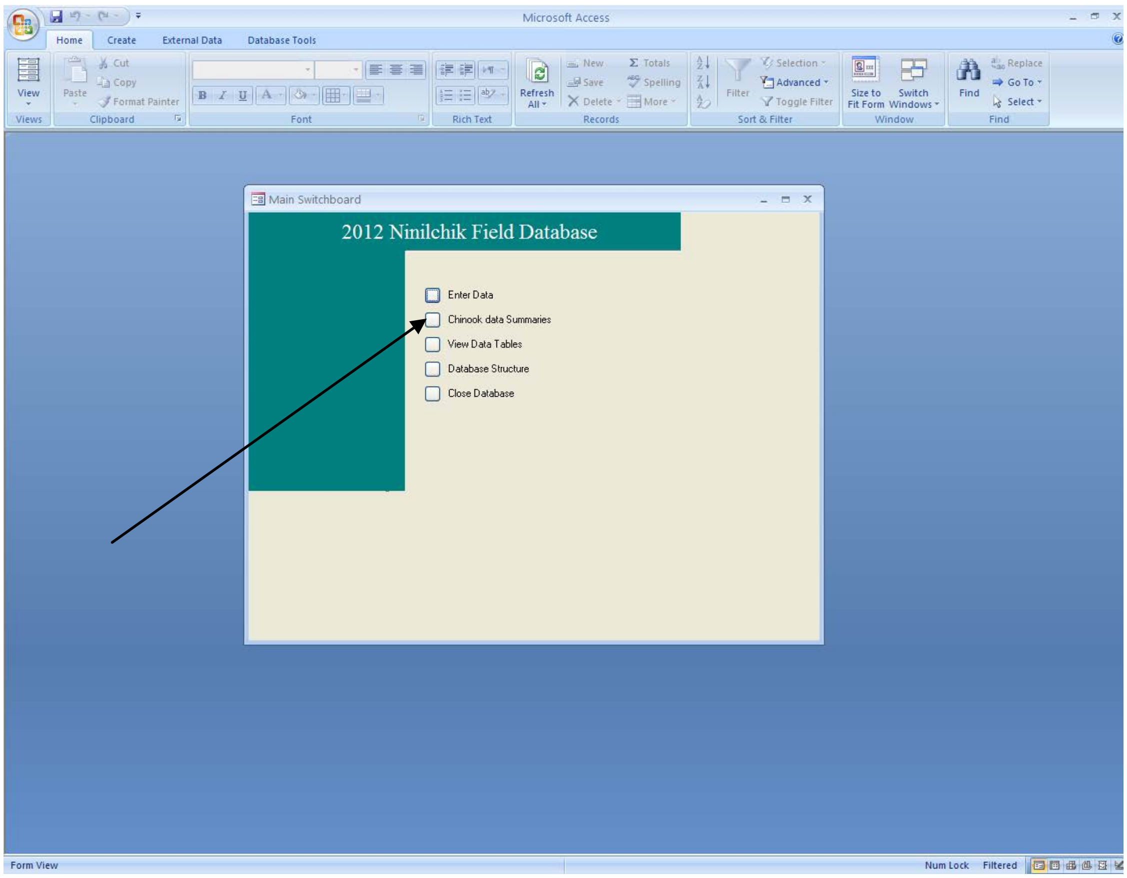
Click on the "Water Data" tab. You will be able to enter both morning and evening water data by using the record selector at the bottom of the form.



Make sure you click on the *"Close Form"* button prior to closing the database.

Appendix C2.- Access generated daily weir operation summaries.

The database will automatically produce data summaries after the data has been entered. With the database opened to the main switchboard, click on the *"Chinook data summaries"* button.



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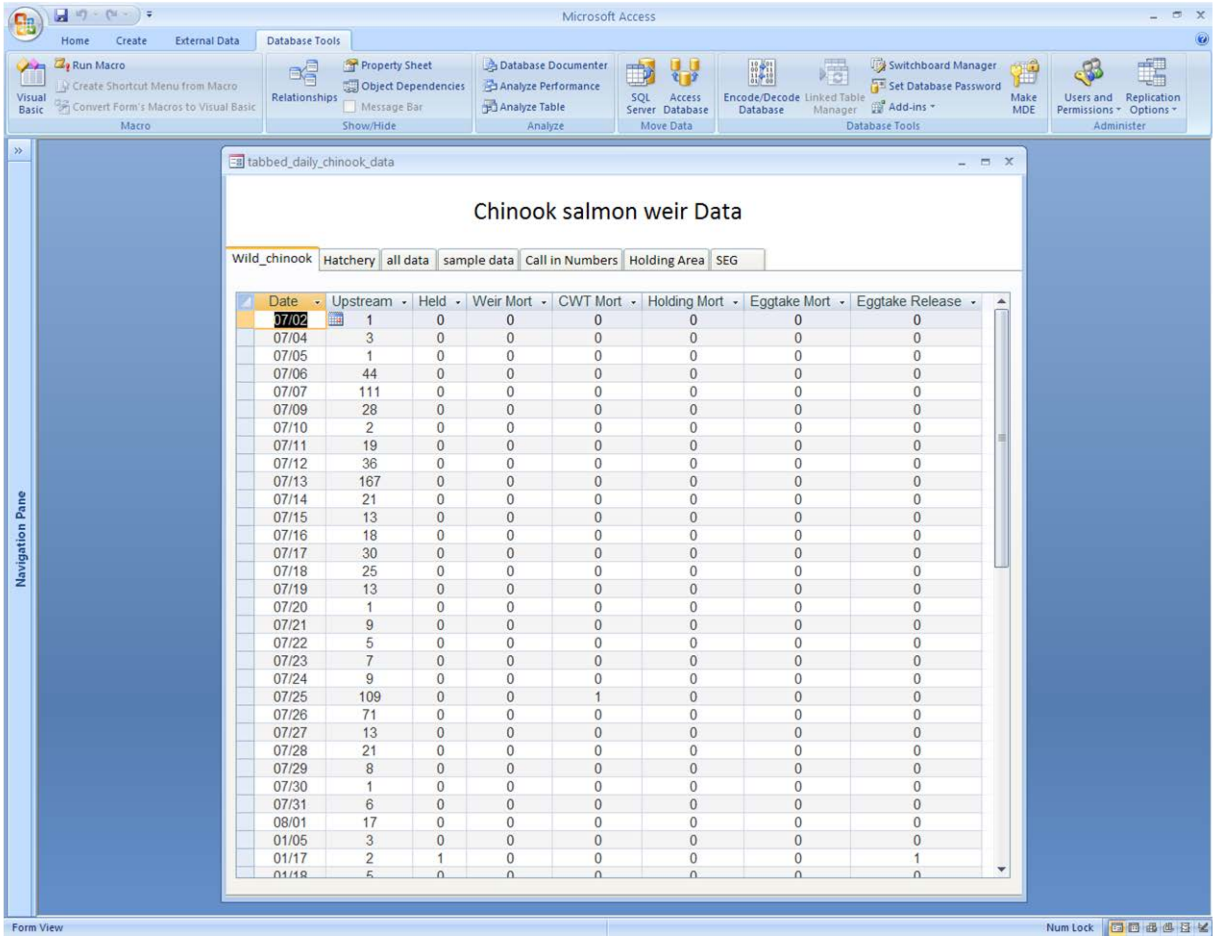
No changes can be made to the data in this view. Using these summaries is a good way to proof the data input.. If there is a discrepancy between the database and your datasheet notify the project field leader.

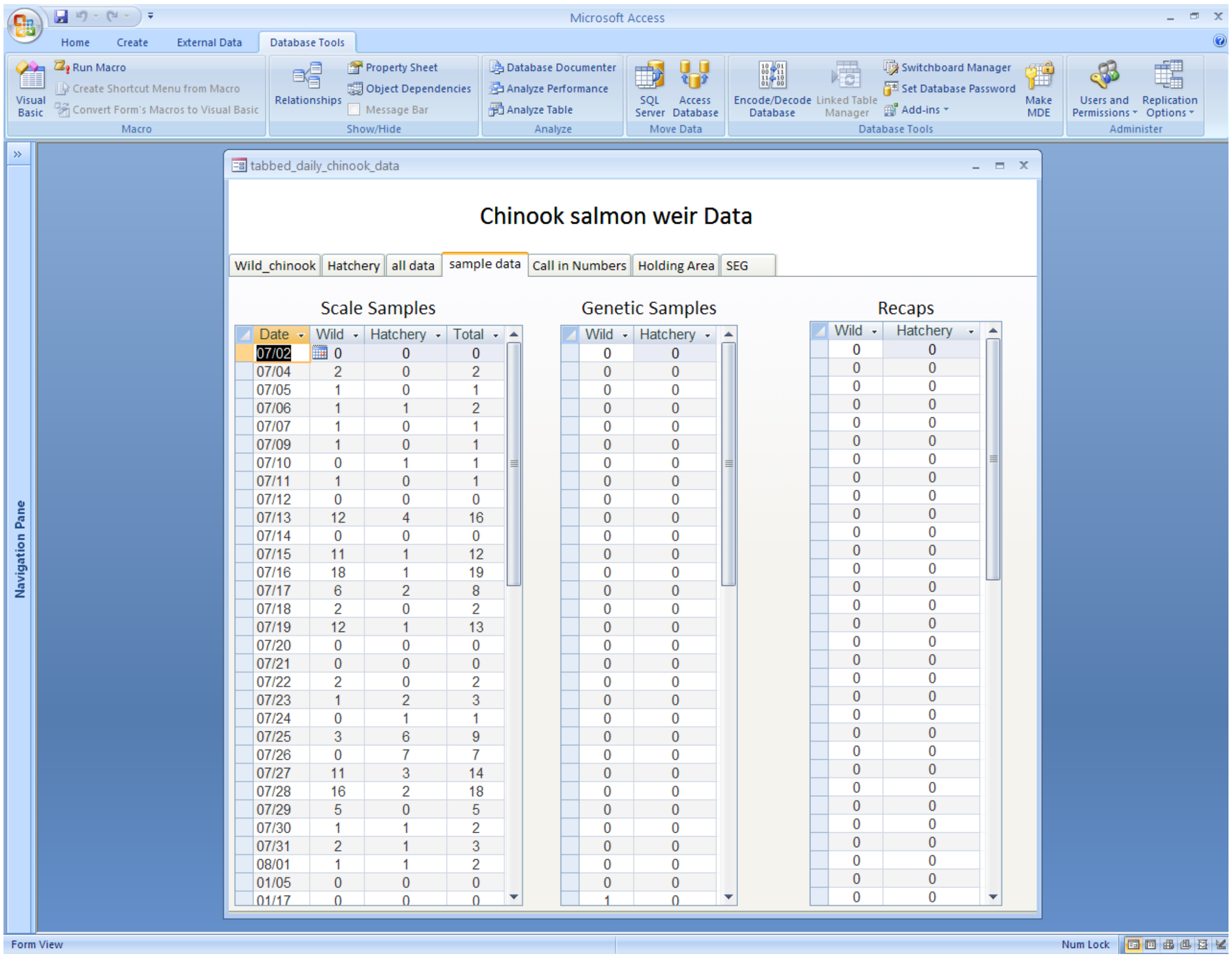


Date	Upstream	Held	Weir Mort	CWT Mort	Holding Mort	Eggtake Mort	Eggtake Release
07/02	1	0	0	0	0	0	0
07/04	3	0	0	0	0	0	0
07/05	1	0	0	0	0	0	0
07/06	44	0	0	0	0	0	0
07/07	111	0	0	0	0	0	0
07/09	28	0	0	0	0	0	0
07/10	2	0	0	0	0	0	0
07/11	19	0	0	0	0	0	0
07/12	36	0	0	0	0	0	0
07/13	167	0	0	0	0	0	0
07/14	21	0	0	0	0	0	0
07/15	13	0	0	0	0	0	0
07/16	18	0	0	0	0	0	0
07/17	30	0	0	0	0	0	0
07/18	25	0	0	0	0	0	0
07/19	13	0	0	0	0	0	0
07/20	1	0	0	0	0	0	0
07/21	9	0	0	0	0	0	0
07/22	5	0	0	0	0	0	0
07/23	7	0	0	0	0	0	0
07/24	9	0	0	0	0	0	0
07/25	109	0	0	1	0	0	0
07/26	71	0	0	0	0	0	0
07/27	13	0	0	0	0	0	0
07/28	21	0	0	0	0	0	0
07/29	8	0	0	0	0	0	0
07/30	1	0	0	0	0	0	0
07/31	6	0	0	0	0	0	0
08/01	17	0	0	0	0	0	0
01/05	3	0	0	0	0	0	0
01/17	2	1	0	0	0	0	1
01/18	5	0	0	0	0	0	0

The first and second tabs contain the wild (default view) and hatchery Chinook salmon data, respectively.

-continued-

The *"Sample data"* tab has all of the data from the grayed section of the datasheet. This tab will help you figure out how many scale samples have been collected.



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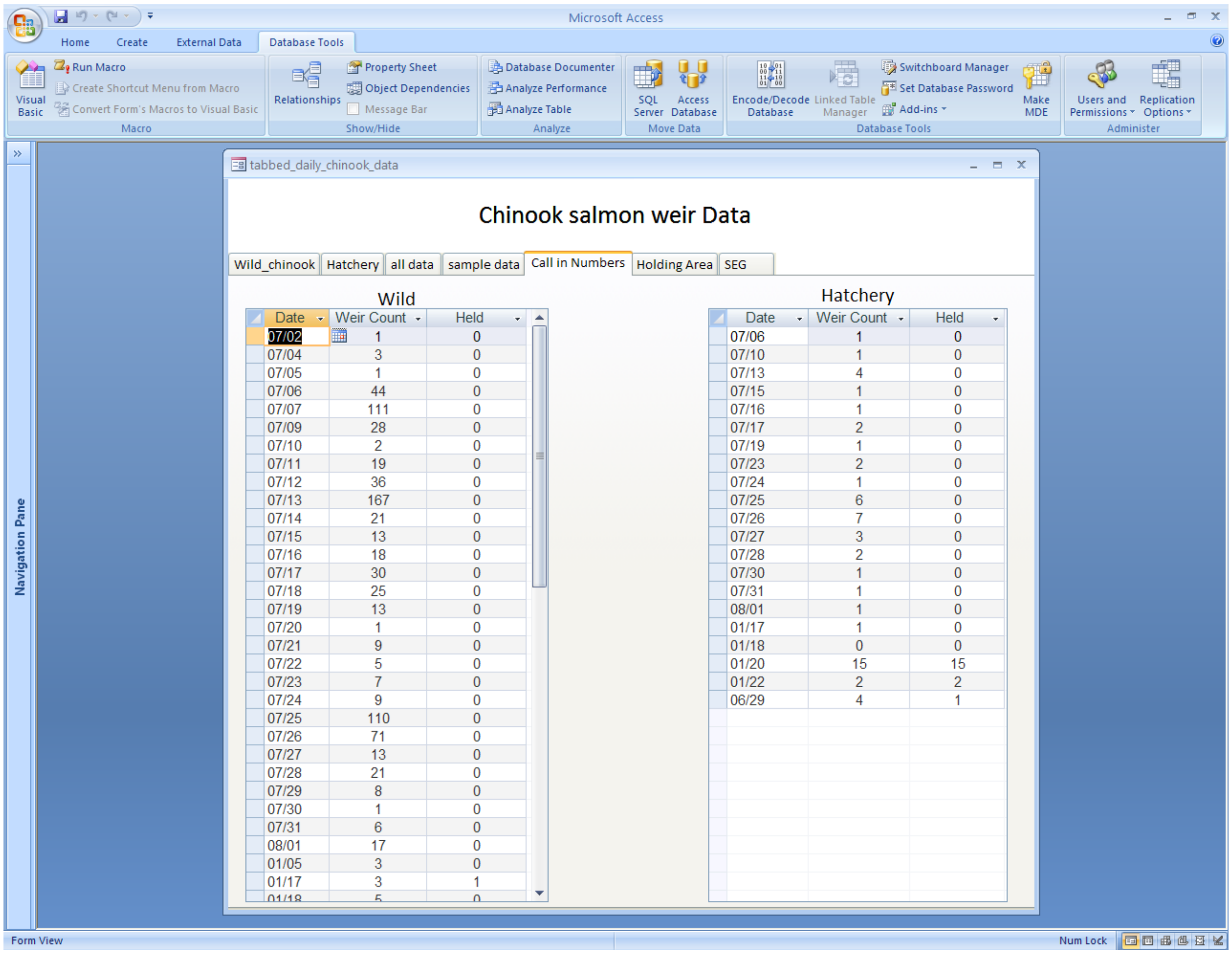
The Call in Numbers tab is probably the most useful. At the end of the day when you need to call in the numbers to the project supervisor, just read the numbers as they are in this form (Date, wild and hatchery weir counts and numbers held).



Wild

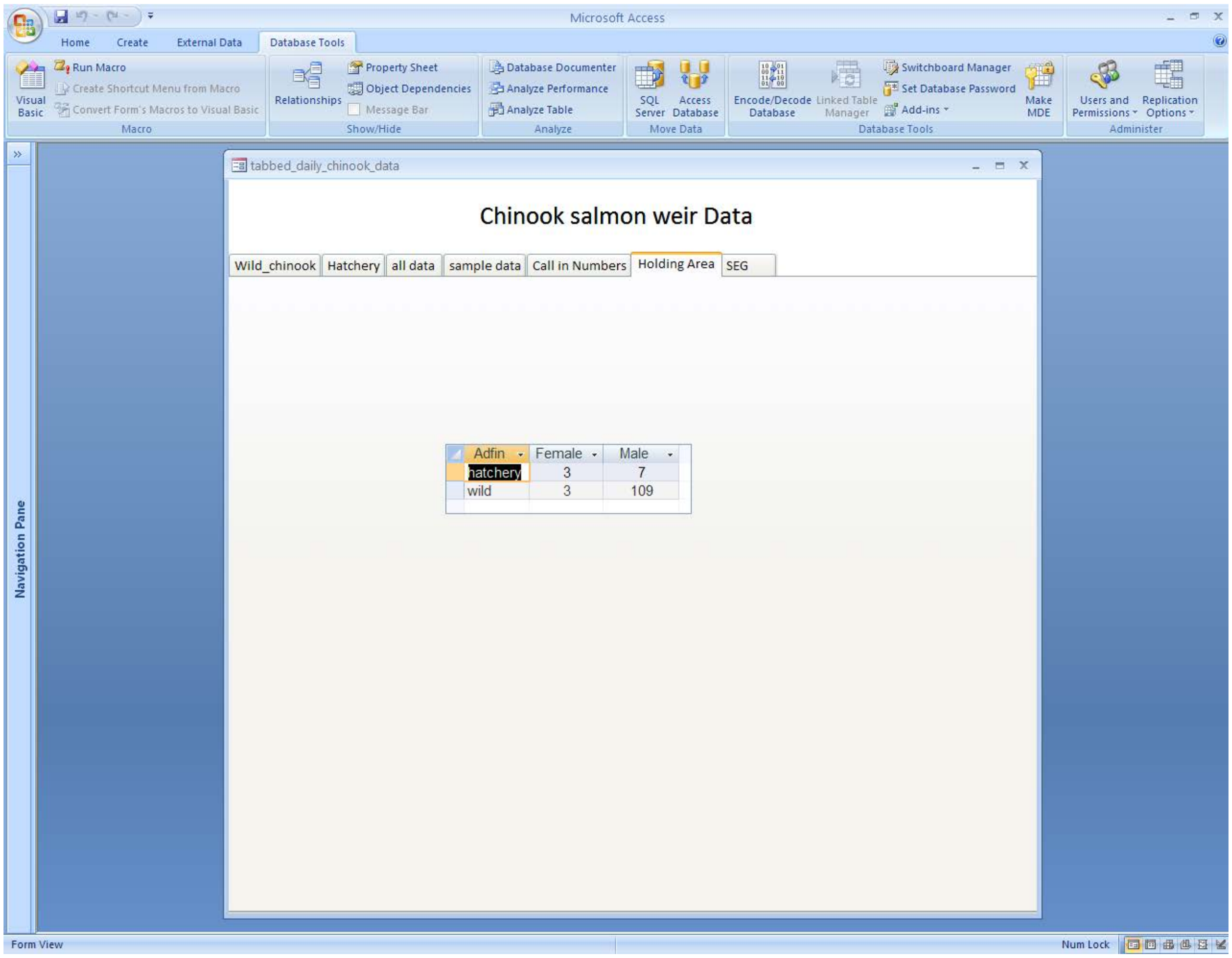
Date	Weir Count	Held
07/02	1	0
07/04	3	0
07/05	1	0
07/06	44	0
07/07	111	0
07/09	28	0
07/10	2	0
07/11	19	0
07/12	36	0
07/13	167	0
07/14	21	0
07/15	13	0
07/16	18	0
07/17	30	0
07/18	25	0
07/19	13	0
07/20	1	0
07/21	9	0
07/22	5	0
07/23	7	0
07/24	9	0
07/25	110	0
07/26	71	0
07/27	13	0
07/28	21	0
07/29	8	0
07/30	1	0
07/31	6	0
08/01	17	0
01/05	3	0
01/17	3	1
01/18	5	0

Hatchery

Date	Weir Count	Held
07/06	1	0
07/10	1	0
07/13	4	0
07/15	1	0
07/16	1	0
07/17	2	0
07/19	1	0
07/23	2	0
07/24	1	0
07/25	6	0
07/26	7	0
07/27	3	0
07/28	2	0
07/30	1	0
07/31	1	0
08/01	1	0
01/17	1	0
01/18	0	0
01/20	15	15
01/22	2	2
06/29	4	1

-continued-

The *"Holding Area"* tab will allow us to keep track of the number of fish in the holding area.



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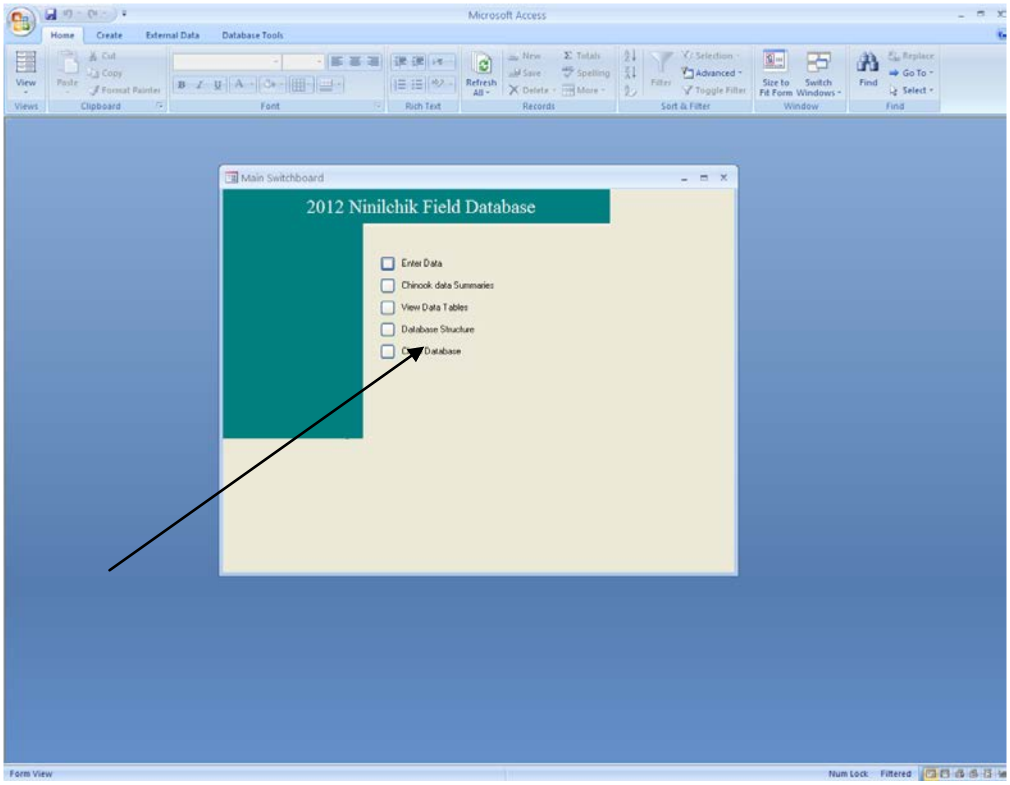
Other species data and water data can be found by pressing *"view Data Tables"* button

on the main switchboard. Click on the tab for the data that you wish to view. These are in view-only table formats.



APPENDIX D.
NINILCHIK RIVER WEIR CREW SCHEDULE

Appendix D1.- Weir crew work schedule.

Day	Date	Activity	Crew
Mon	7/1	holding area install/ weir operation	All/ Marge Tillion
Tue	7/2	holding area install/ weir operation	All/ Marge Tillion
Wed	7/3	weir operation	Marge Tillion
Thu	7/4	weir operation	Holly Dickson
Fri	7/5	weir operation	Holly Dickson
Sat	7/6	weir operation	Holly Dickson
Sun	7/7	weir operation	Holly Dickson
Mon	7/8	weir operation	Marge Tillion
Tue	7/9	weir operation	Marge Tillion
Wed	7/10	weir operation	Marge Tillion
Thu	7/11	weir operation	Marge Tillion
Fri	7/12	weir operation	Holly Dickson
Sat	7/13	weir operation	Holly Dickson
Sun	7/14	weir operation	Holly Dickson
Mon	7/15	weir operation	Holly Dickson
Tue	7/16	weir operation	Marge Tillion
Wed	7/17	weir operation	Marge Tillion
Thu	7/18	weir operation	Marge Tillion
Fri	7/19	weir operation	Marge Tillion
Sat	7/20	weir operation	Holly Dickson
Sun	7/21	weir operation	Holly Dickson
Mon	7/22	weir operation	Holly Dickson
Tue	7/23	weir operation	Holly Dickson
Wed	7/24	weir operation	Marge Tillion
Thu	7/25	weir operation	Marge Tillion
Fri	7/26	weir operation	Marge Tillion
Sat	7/27	weir operation	Marge Tillion
Sun	7/28	weir operation	Holly Dickson
Mon	7/29	weir operation	Holly Dickson
Tue	7/30	weir operation	Holly Dickson
Wed	7/31	weir operation	Holly Dickson
Thu	8/1	weir operation	Holly Dickson
Fri	8/2	weir operation	Jon Kee
Sat	8/3	weir operation	Tim Blackmon
Sun	8/4	weir operation	Tim Blackmon
Mon	8/5	weir removal	All
Tue	8/6	weir removal	All